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CHEMICAL AND MORPHOLOGICAL PARAMETERS OF SWEET CORNS INFLUENCED BY PRODUCTION METHOD

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Abstract: This field experiment was conducted to see the influence of production methods (open field/green house) on some morphological and chemical characteristics of super sweet (SH2) corn hybrid. The study was established at a local farm in Bogojevce (Municipality of Leskovac, South Serbia). The highest values of morphological characteristics (total plant hight and first cob hight) were achived when Sweet Nugget F1 was grown at open field. The production method did not have statistically significant impact on the average velues of the observed morphological parameters. The highest amount of total sugar and invert sugar in maize kernel was achived when grown in open field with the values of 11.04% and 7.24% respectively. When grown under greenhouse conditions, the total sugar amount was 8.04%, whereby the amount of invert sugar was 4.29%. A positive and very strong correlation between total sugars and invert sugars was observed.

Keywords: sweet maize, production conditions, morphological characteristics, total sugars, invert sugars.

Introduction

Sweet corn (*Zea mays* L. var. *saccharata* Sturt.) possesses a kernel very rich with proteins, fats, minerals, fibers and sugars (Budak and Aidemir, 2018; Srdić et al., 2019; Matejić et al., 2024). The kernel is soft, juicy, sweet and very tasty at milk stage (Ugur and Maden, 2015). Based on those facts, kernels can be consumed as fresh or processed (Rattin et al., 2018; Tupajić et al., 2024; Šević et al., 2024). Sweet corn is grown on about 5000 ha in the Republic of Serbia (Šević et al., 2024), and beside the small area on which sweet corn is grown, it may earn a good profit for growers with a tendency of increase in the number of hectares. The increased demand for fresh sweet corn requires an increase in its production, especially outside the conventional growing season (May-

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September), which has become a challenge, because of the rapid decrease in kernel quality after milk stage (Alan et al., 2014; Gavrić et al., 2020). The optimal productivity and sweet corn kernel quality depend mostly on several factors, such as production conditions and irrigation regime, which have influence on crucial production characteristics. The key to a stable production depends mainly on the level of applied agricultural practices , selected hybrid , weather conditions during the growing season (Stojiljković et al., 2023). The goal of this study was to determine the influence of production method (open field VS greenhouses) on plant height, first cob height and the amount of total sugars as well as invert sugars.

Materials and methods

The field experiment was established during 2024, on a local farm in Bogojevce (43°05'38.31" N, 21°96'77.54" E) (Municipality of Leskovac, South Serbia). The experiment was arranged as a completely randomized block system, in three replications with 40 plants per replication. Sweet corn was grown under open field and green house conditions (41x8x3.5m) on 225 altitude. The selected hybrid was Sweet Nugget F_1. Plants were planted directly, both on open field and in green house. The seed was planted in two-row strips. The distance between strips was 70cm, between two rows in a strip 20 cm as well as between seeds in a row. Planting was conducted on May the 18th 2024 in both, open field and green house. All necessary agrotechnical measures of crop care were conducted (fertigation, drop by drop irrigation, spraying against weeds and insects). The measurements were taken immediately before harvesting. The content of total sugars and invert sugars was determined volumetric, using the Luff-Schoorl method. The measurements were conducted in triplication (one plot = three samples), and the results are presented in percentages of dry matter.

Data was analyzed by using IBM SPSS Statistics, version 26.0. Analysis of variance (ANOVA) was used to assess the impact of the production method, with significance levels of $p<0,05$ and $p<0,01$. The LSD test (least significant differences) was used to test the influence of the examined factors. Pearson correlation analysis was run to determine the relation between examined sweet corn characteristics, and all the data is presented graphically.

Results and discussion

Plants grown under greenhouse conditions (plastic and glass) are uniformly developed because of the well distributed microclimate and higher temperatures inside during colder period of year (Kwabiah et al., 2004). Based on the previous research, many different techniques were studies to enhance seed emergence, growth and maturity of many vegetables, including tomato, cucumber, Chinese cabbage and beet (Gimenez et al., 2002), but very minimum research has been conducted about the influence of greenhouses on morphological and chemical characteristics of sweet corn.

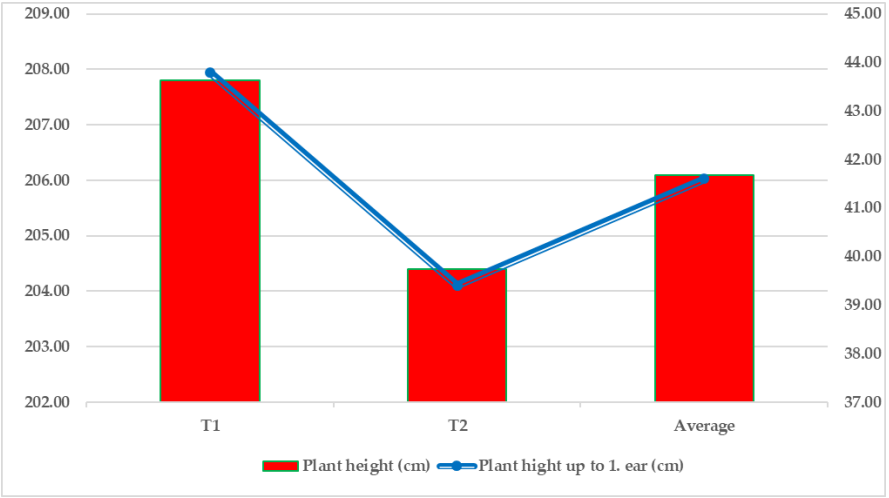

Figure 1. Average values of sweet corn plant height and plant height up to 1 ear (cm), ***Legend:*** T1 – open field, T2 – protected area (greenhouse).

The average plant hight and first cob hight are presented at Figure 1. The production method did not have a statistically significant impact on the average values of both morphological and chemical characteristics (Table 1). The highest values for morphological parameters were achived when sweet corn was grown on open field (T1). The highest average plant height was 207.80 cm and the highest average cob height was 43.80 cm. Under greenhouse conditions (T2) the average values of these parameters were lower. The average plant hight in T2 was 204.40 cm and the average first cob hight was 39.40 cm. According to some authors (Đurić et al., 2015), the plant height depends on the genotype and growing conditions. Although the plant height is a genotypic characteristic, it is not constant and it may vary, based on the growing conditions during the

period of elongation. Plant height and first cob height depend on the hybrid, agroecological conditions and agroecological measures (Mandić, 2011; Živanović, 2012; Jovanović et al., 2024). The kernel quality of sweet corn is expressed by determining the amount of sugar in kernel (Szymanek et al., 2015). The sugar content in sweet corn depends on several factors, whereby the most important are selected genotype, applied agrotechnical measures, production methods and harvesting time (Abadi et al., 2019).

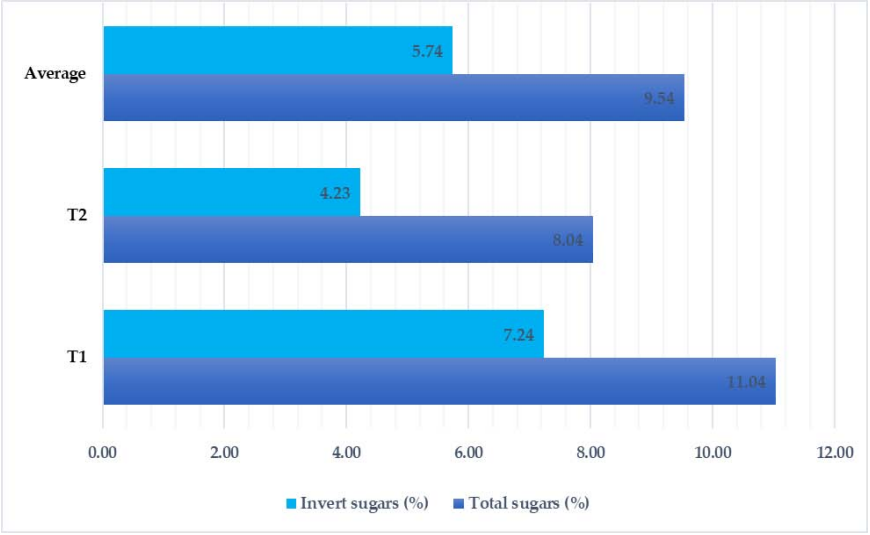

Figure 2. Average values of total and invert sugar content in sweet corn kernel (%) ***Legend:*** T1 – open field, T2 – protected area (greenhouse).

After analyzing the amount of total sugars and invert sugars, the production method caused statistically significant impact on obtained values (Figure 2). The highest content of total sugars and invert sugars was obtained when grown on open field (T1) 11.04 % and 7.24 % respectively. By growing sweet corn under greenhouse conditions, the observed values were much lower. Total sugars were 8.04 % and invert sugars were 4.29 %.

Table 1. Analysis of variance for the influence of factors and significance on the obtained values of the studied parameters

Source			Cultivation method		Eror		Total	
df			1		4		6	
Parameter		SS	MS	F	Sig.	Lsd p<0.05	Lsd p<0.01	C.V (%)
Plant height (cm)	Cultivation method Eror Total	17.002 571.367 255492.8	17.002 142.84	0.119 ns	0.75	27.09	44.93	5.80
Plant height up to 1 ear (cm)	Cultivation method Eror Total	29.040 271.89 10700.9	29.04 67.97	0.427 ns	0.55	18.69	30.99	19.80
Total sugars (%)	Cultivation method Eror Total	14.602 3.366 570.928	14.602 0.842	17.35 *	0.01	2.08	3.45	9.60
Invert sugars (%)	Cultivation method Eror Total	13.590 4.000 214.932	13.590 1.000	13.59 *	0.02	2.27	3.76	17.40

Legend: S -Source, df: Degrees of freedom; SS: Sum of Squares; MS: Mean squares; F: F-statistic (F-value); Sig.: significance level (p-value); ns nonsignificant; **p < 0.01; *p < 0.05, C.V.: Coefficient Variance.

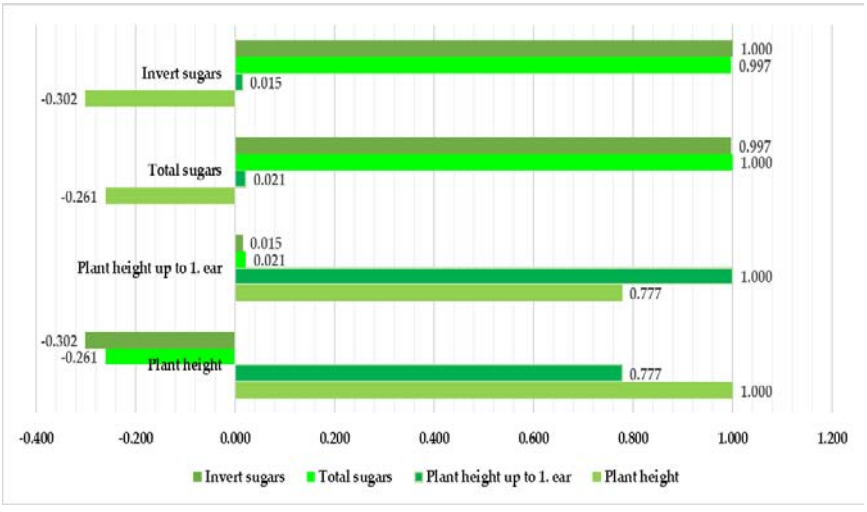

Figure 3. Correlation coefficients between the studied productive traits of sweet corn hybrid (plant height, plant height up to 1 ear) and and the content of different types of sugar in the kernel of the sweet corn hybrid (total and invert sugars). Correlation is significant at the 0.01 level**

Correlation coefficient between both morphological and chemical characteristics showed different level of strength (Figure 3). Positive and strong correlation between plant height and plant height up to first cob was observed (r=0.777), whereby negative correlation between plant height and total sugars (r=-0.261) as well as between plant height and invert sugars (r=-0.302). Between plant height up to first cob and total sugars a positive but very weak correlation was found (r=0.021) as well as between plant height up to first cob and invert sugars (r=0.015). The correlation is positive and very strong between total sugars and invert sugars (r=0.997**), which has earlier been claimed by Ganesan et al. (2017).

Conclusion

Based on the obtained results, the production method plays a crucial role for sweet corn kernel quality. Production method of sweet corn (open field and greenhouse) did not have a statistically impact on the observed morphological parameters, but higher values were observed when grown on open field. Statistically much higher content of total sugars and invert sugars in sweet corn kernels were observed when grown on open field then when grown under greenhouse conditions, 11.04 % and 7.24 % respectively. By growing sweet corn under greenhouse conditions, the amount of total sugars and invert sugars was 8.04 % and 4.29 %. A positive and very strong correlation between total sugars and invert sugars was observed.

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