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The effect of increasing plant density on sweet corn (*Zea mays* var. *saccharata*) ear parameters

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Abstract: The ear parameters of sweet corn, such as ear length, ear diameter, kernel depth, and number of kernel rows, are crucial in determining the quality and quantity of the yield. These parameters can vary depending on the variety and growing conditions, and they have a significant impact on market value and consumer satisfaction. The ear length of sweet corn can generally range from 15 to 25 cm, depending on the variety. Longer ears can contain more kernels, which increases the yield. The cob diameter can vary between 3 and 5 cm, also depending on the variety. The proportion of the diameter made up by the corn kernel and the ear is determined by the kernel depth. The greater this value, the higher the kernel yield of the ear. The genotype of sweet corn fundamentally determines the ear parameters, but they can change due to various factors, which can be genetic, environmental, or agronomic in nature. Among the agronomic factors, nutrient supplementation and the proper setting of plant density have the greatest impact on ear parameters. In overly dense stands, the plants compete for nutrients and water, which can result in smaller ears. Consequently, in our experiment, we investigated the highest applicable plant density in sweet corn cultivation that does not negatively affect the various ear parameters. In the experiment, we examined the same sweet corn hybrid in a total of 6 different populations with 4 repetitions in Szarvas in 2023. The applied populations were as follows: 56,000; 58,000; 62,500; 65,000; 71,000 and 75,000 plants per hectare. From the measured results, it was determined that with the increase in plant density, the values of ear length, ear diameter, and kernel depth improved up to a certain point and then slightly decreased. However, the population numbers used in the experiment did not have a significant impact on the number of kernel rows on the cobs. In the averages of the repetitions, 14, but mostly 15 rows of kernels were observed everywhere. The best values for ear length (22.08 cm), ear diameter (5.04 cm), and kernel depth (1.12 cm) were achieved in the 65,000 plants per hectare treatment. This supports the fact that the generally recommended optimal plant density in sweet corn cultivation is 65,000 plants per hectare. In addition, based on the obtained results, it can be concluded that the population numbers used in the experiment can potentially be increased in future experiments. In the case of sweet corn cultivation for the canning industry, even 75,000 plants per hectare can be applied, as there was no significant deterioration in the properties of the ears.

• Introduction

Ear length, ear weight, ear diameter, and kernel depth are all crucial traits for sweet corn yield and quality. These traits are influenced by genetic factors, environmental conditions, and agronomic practices, making them important considerations in sweet corn breeding and cultivation. Ear length is a significant trait for sweet corn yield. It has been shown to have a direct positive effect on fresh ear yield, making it a primary selection criterion for sweet corn breeding (Oktem, 2008). Additionally, ear length can be influenced by factors such as seed size, with larger seeds generally producing longer ears (Kara, 2011). Ear weight is another critical trait, directly affecting the overall yield of sweet corn. It is influenced by various factors including genetic traits and environmental conditions. For instance, ridge-planting patterns can impact ear weight, with certain patterns leading to higher fresh ear weights (Xu et al., 2014). Moreover, ear weight is closely related to ear length and diameter, as well as kernel depth (Yin et al., 2021). Ear diameter, like ear length, is positively correlated with fresh ear yield. It is considered a secondary characteristic but still important for yield improvement (Oktem, 2008). Kernel depth is a trait that can be stably inherited within certain maize clusters (Liu et al., 2011). Weeds' interference significantly affects it, which can reduce the depth of the kernel. Kernel depth contributes to the overall ear weight and is a key factor in determining the quality and yield of sweet corn.

• Material and method

The experiment was set up in Szarvas on the School Field of the Department of Irrigation and Land Improvement of the Institute of Environmental Sciences of the Hungarian University of Agricultural and Life Sciences. During the experiment, we examined the Zeaton F1 sweet corn hybrid in a random block arrangement. In the experiment, the Zeaton hybrid was examined in 6 different plant populations (56, 58, 62.5, 65, 71 and 75 thousand plants/ha). The experiment took place in an area of approx. 2000 m². The 6 different treatments mentioned above were tested in 4 repetitions. Each plot was 6 rows wide and 15m long, and the used row spacing was 75 cm. The seeds were sown on 13th June with a 6-row seed drill. It was not necessary to perform corn thinning. The collection of crop samples from all treatments was uniformly done on the same day, September 12th (Figure 1).



Figure 1: Measurement of sweet corn cob length

• Results and discussions

Figure 2 presents the results of ear diameter for the different treatments. It can be observed from the figure that the largest diameter ears were harvested from the 65,000 population, with an average value of 5.04 cm. The smallest diameter corn ears came from the 56,000 population, with an average value of 4.66 cm. It can be observed from the figure that the ear diameter values increased up to the 65,000 treatment, and then continuously decreased for higher populations.

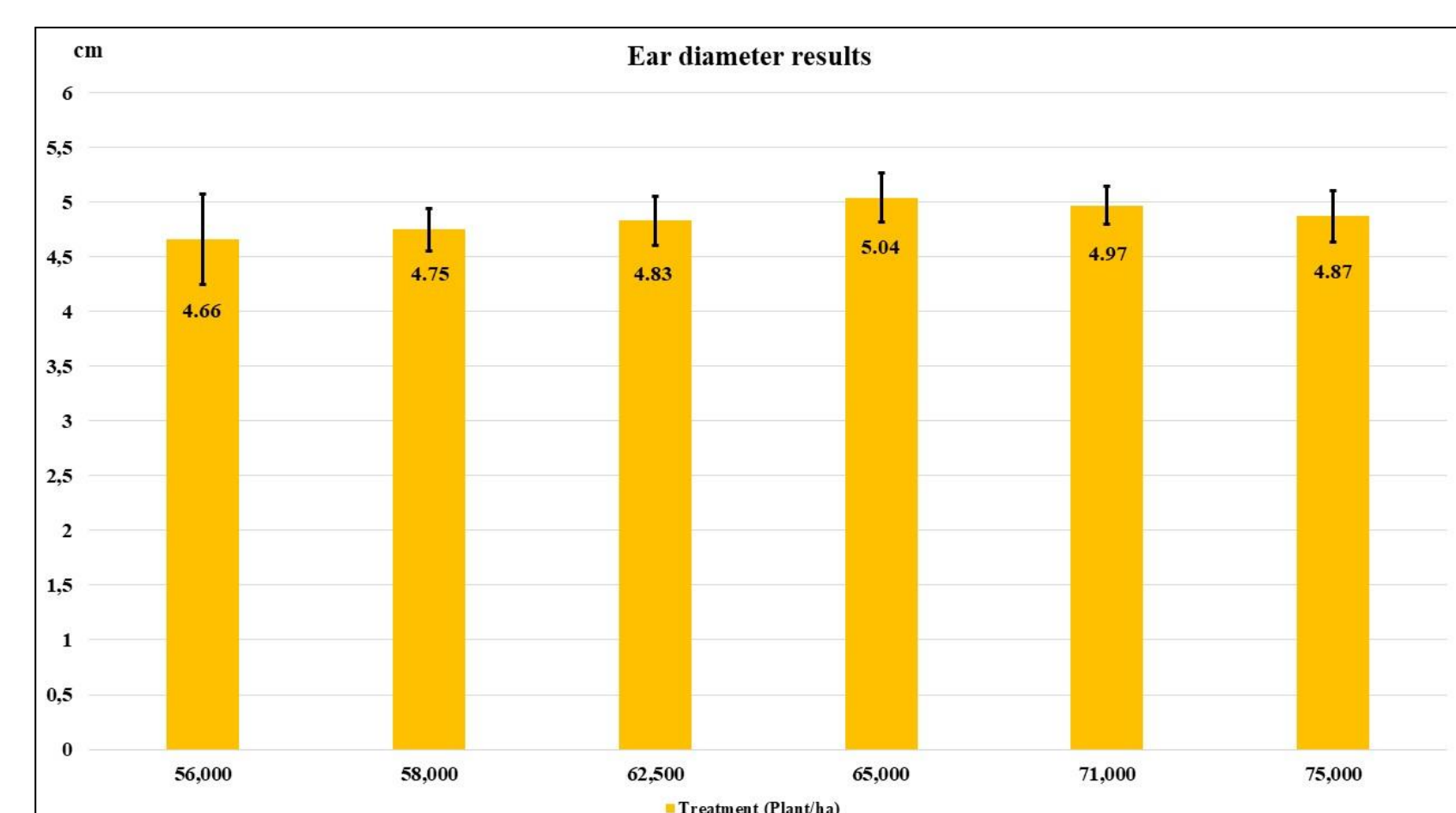


Figure 2: Ear diameter results

Figure 3 illustrates the kernel depth results for the different treatments. The highest kernel depth results were also achieved in the 65,000 population treatment, with an average value of 1.12 cm, while the smallest kernel depth results were observed in the 56,000 population.

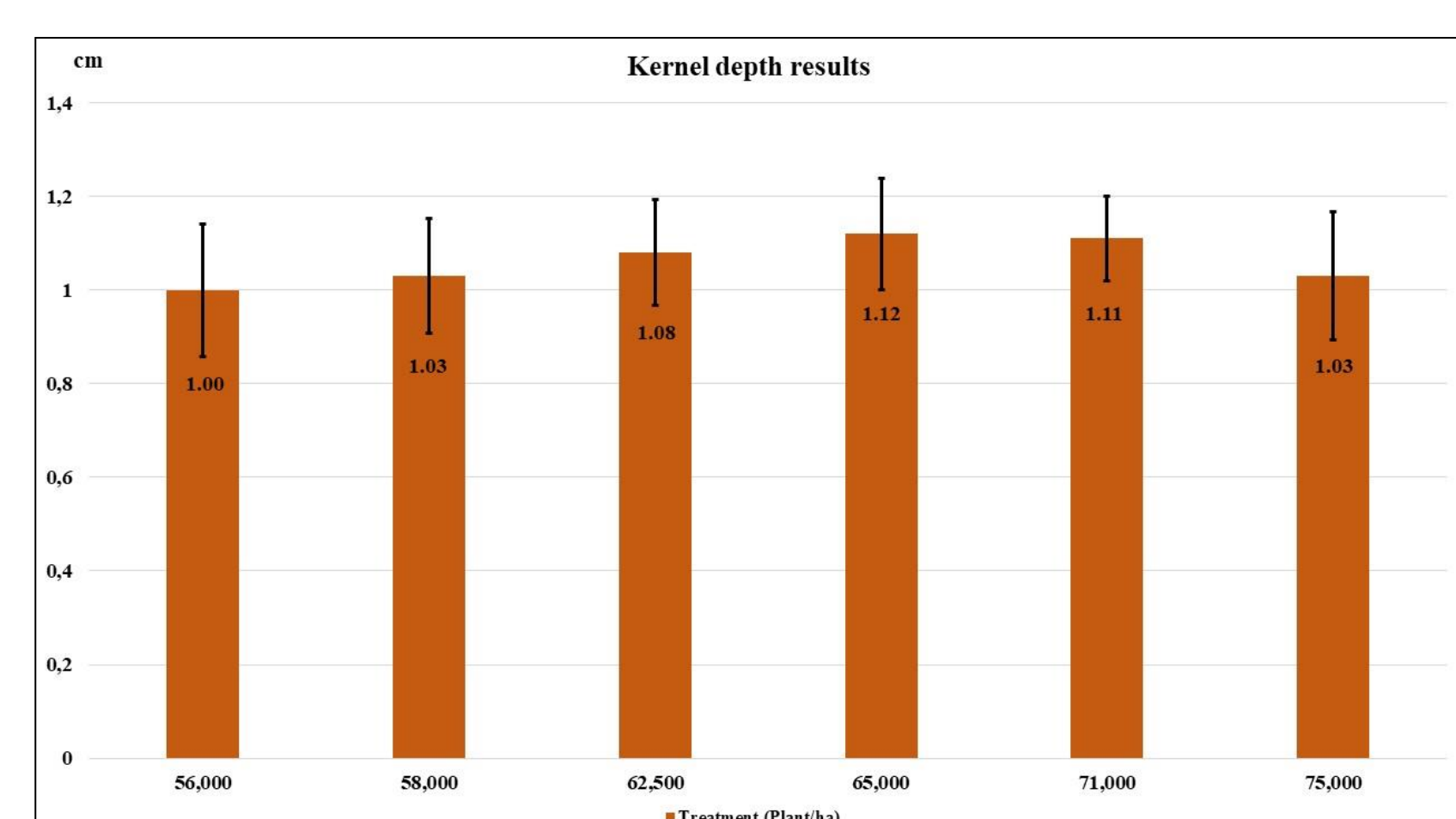


Figure 3: Kernel depth results

• Conclusions

Comparing the results of the two graphs, it can be stated that there is a direct proportionality between kernel depth and ear diameter results. The cob diameter results changed in the same way as the kernel depth values. This also shows that kernel depth values always influence the ear diameter results. Additionally, it can be supported that the generally recommended optimal plant density in sweet corn cultivation is 65,000 per hectare, as the most suitable ear characteristics were observed at this population size for the hybrid studied.