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Effect of increasing plant population density on the yield parameters and profitability of sweet corn

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Abstract: *In the case of sweet corn grown for the canning industry, the most important aspect for the producers is to produce the raw material that best meets the canning industry's expectations, in addition to the highest yield possible in this form. The purpose of this experiment is to investigate the highest possible number of plants that does not yet have a negative effect in terms of the size of the cobs and the quantity of shelled grains. Currently, the most commonly used number of sweet corn plants by farmers producing for the canning industry is 65 thousand plants/hectare, which can certainly meet the expectations of the canning industry. Therefore, in our research, we examined the highest possible number of plants for a newly marketed sweet corn hybrid, which does not yet have a negative effect on the harvested cob yield, the size of the cobs, and the quantity of shelled grains, but increasing the number of plants is still profitable. In the experiment, we examined the same sweet corn hybrid in a total of 6 different populations in 4 repetitions in Szarvas, in 2023. The populations applied were as follows: 56; 58; 62.5; 65; 71 and 75 thousand plants/hectare. During the experiment, we examined the weight of the harvested cob yield and shelled grains, as well as the length of the cobs. In addition, the experiment also extended to the profitability of the populations. The experiment pointed out that increasing the number of plants per hectare of the examined sweet corn hybrid is worthwhile in terms of increasing the quantity of cob yield and shelled grain yield. However, above 65 thousand plants per hectare, the length of the cobs showed a minimally decreasing tendency, but even so, it still met the needs of the processing industry.*

• Introduction

Sweet corn is the vegetable crop grown on the largest area in Hungary (https 1). The rapid increase in its cultivated area was primarily due to the fact that its cultivation, from sowing to harvesting, can be well mechanized without significant risk of quality degradation (Hodossi és Kovács, 1996). Hungary's climatic, topographic, and soil conditions are also suitable for the cultivation of sweet corn, which also favors its spread (https 1). Its cultivation takes place on an average of about 37 thousand hectares annually in the country (https 1,2). In Hungary, modern cultivation was established by the mid-to-late 80s. The big breakthrough happened in the mid-90s. Although the yield fluctuated slightly, the sown area continued to grow. The driving force of this growth was the canned and refrigerated industry (https 3). Sweet corn can be processed in many ways, but most of the products are canned or frozen. Fresh market sweet corn is most often boiled from the cob and consumed as such (Marshall and Tracy, 2003). Among the canned industry's expectations for sweet corn are high sugar content, uniform size and color of the kernels, and the length and thickness of the cobs. The kernels must be healthy and free from pests and diseases (https 3). Currently, the most commonly used sweet corn plant number by farmers producing for the canned industry is 65 thousand plants/ha, which can certainly meet the following expectations. Excessive plant density can be detrimental in terms of meeting the canned industry's expectations. If the plants are too close to each other, competition for light, water, and nutrients can reduce yield and cob size. In addition, air circulation decreases in too dense a stand, which increases the risk of diseases (https 5). Variety selection also plays an important role in meeting the canned industry's expectations. Farmers who want to sell the earliest usually choose the earliest maturing Dessert R68, but they also grow the Dessert 70, Dessert 73, and Dessert R78 varieties (https 4).

• 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 m^2. 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 experiment was conducted with drum irrigation (*Figure 1*) on meadow chernozem soil, nutrient replenishment and pest control were carried out using traditional agronomic practices. The collection of crop samples from all treatments was uniformly done on the same day, September 12th.

• Results and discussions

Table 1 presents the results of grain yield and crop yields as a function of plant population. Plant population density had a significant effect on yield expressed in tons per hectare. On average, the weight of yields was significantly higher in populations of 75,000 and 71,000 plants per hectare than in populations of 56,000 plants per hectare.

Grain yield			
Treatment Plants/ha)	**Cob yield (t/ha)**	**Cob (t/ha)**	**Grain crop (t/ha)**
56,000	17.82	6.74	11.08
58,000	19.42	7.23	12.19
62,500	20.75	7.98	12.77
65,000	22.08	8.18	13.9
71,000	23.2	8.7	14.5
75,000	23.55	8.15	15.4

Table 1: Grain yield results

As the population increased, the cob length slightly decreased. However, this relationship was not strictly linear. *Figure 2* presents the results of cob length.

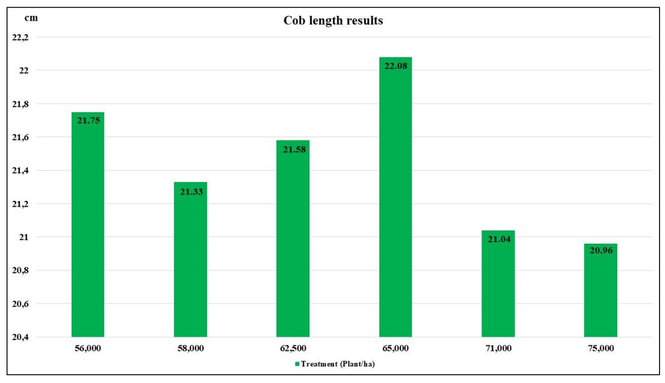

Figure 2: Cob length results

• Conclusions

The yields increased linearly with the growth of the plant population. With the increase in plant count, the length of the corn cobs decreased only minimally, even at a treatment of 75,000 plants per hectare, it met the requirements of the canning industry. This means that the Zeaton F1 hybrid can be grown for canning purposes even with this number of plants per hectare.

Figure 1: Irrigation of the experiment with a cantilever irrigation device