# Growing varieties sweet corn main period in Karakalpakstan

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**Abstract.** This article investigates the impact of planting the "Zamin" variety and "Megaton F1" hybrid of sweet corn in the moderately saline meadow-alluvial soils of the Republic of Karakalpakstan. The study specifically focuses on the effects of planting these hybrids at different periods—April 20, May 1, and May 10—on various aspects of plant growth, development, vegetable cob productivity, and economic efficiency indicators. The findings indicate that when seeds of the "Zamin" variety and "Megaton F1" hybrid of sweet corn were planted on April 20, remarkable results were observed. The plants exhibited impressive height, ranging from 163.7 cm to 173.3 cm. Additionally, they were characterized by a substantial number of leaves (12.0 to 12.1 pieces) and seeds (3.0 to 3.6 pieces), showcasing robust growth and development. Furthermore, the productivity of these early-planted varieties was noteworthy, with a yield of 10.8 tons per hectare for the "Zamin" variety and 11.8 tons per hectare for the "Megaton F1" hybrid. Importantly, this represented an additional yield of 1.1 to 1.3 tons per hectare compared to the control, highlighting the positive impact of the early planting strategy. These results underscore the significance of the planting period in maximizing the growth, development, and overall productivity of sweet corn varieties in the specific agro-climatic conditions of Karakalpakstan. The study's insights contribute valuable information for local farmers and agricultural practitioners, offering a practical approach to enhancing crop yield and economic efficiency in sweet corn cultivation.

## 1 Introduction

It is possible to solve the food problem by increasing the variety of food crops in the world, creating new varieties and hybrids, adapting high-quality high-yielding varieties and hybrids to different soil and climatic conditions, and expanding the geographical distribution [1]. Including sweet corn, as it is suitable for growing in unfavorable soil (saline) conditions compared to other crops, it is grown in many countries of the world and its cob is consumed as a vegetable, and the need for it is increasing day by day [2].

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Indeed, sweet corn has ascended to become one of the most crucial vegetable crops. The sweet corn cob, particularly during the milk-wax ripening stage, exhibits a composition rich in essential nutrients. At this stage, the sweet corn cob comprises approximately 31.2% dry matter, with a breakdown of 24% carbohydrates, 10% dextrin, and 3.7% protein [3].
The protein content in sweet corn is of particular significance as it contains essential amino acids, including lysine and tryptophan. These amino acids are considered indispensable for the human body, as they are not readily synthesized and must be obtained through dietary sources [4]. Lysine plays a crucial role in protein synthesis and is vital for the formation of collagen, enzymes, and antibodies. Tryptophan, on the other hand, is a precursor for serotonin, a neurotransmitter that contributes to mood regulation and overall well-being [5].
The nutritional profile of sweet corn, especially with its valuable protein content and essential amino acids, positions it as a beneficial dietary component. This makes sweet corn not only a flavorful and versatile vegetable but also a valuable source of nutrients with potential health benefits. The recognition of lysine and tryptophan in sweet corn underscores its significance in contributing to a well-balanced and nutritionally rich diet [6].
The nutritional value of sweet corn is not inferior to beans and green peas, as it contains 4% protein, 12-14% starch, 5-8% sugar, 1.2% oil [7]. Sweet corn is a high-income crop, its grain (cob) is of primary importance, and the timing of the crop's release to the market determines its price. The results of the experiment showed that the cultivation of sweet corn varieties in the growth period is profitable compared to the cultivation in the late periods [8]. Today, when growing sweet corn for fresh consumption or processing, hybrids are becoming more important than varieties [9].

## 2 Materials and methods

Field experiments were conducted (2018-2020) Amudarya district is located in the southern part of the Republic of Karakalpakstan. The area is 1.02 thousand $km^2$, the terrain of the district is mainly flat. Jumurtov Ridge is located along the left bank of Amudarya. The climate of the Republic of Karakalpakstan is sharply continental, with dry summers and relatively cold winters, with little precipitation. Annual precipitation is 110 mm, mainly in winter and spring. The duration of frost-free days is 194-214 days. The soils of the area where the experiments were conducted are moderately saline, meadow-alluvial soils, the total amounts of nutrients in the arable layer (0-30 cm), nitrogen 0.097%, phosphorus 0.141%, and potassium 1.30%, and in the lower layer (30-50 cm) and, respectively, 0.056%; 0.119%. It was observed that it decreased to 1.20%.
The purpose of the research is to select the varieties and hybrids of sweet corn suitable for cultivation in medium saline meadow-alluvial soils of the Republic of Karakalpakstan, to scientifically justify the technology of cultivation of optimal planting periods as a fallow crop. The objectives of the research are: to select suitable varieties and hybrids for the growth, development, high and quality yield of sweet corn in the moderately saline meadow-alluvial soil-climate conditions of the Republic of Karakalpakstan, and to determine the dependence of their cultivation on optimal planting periods. The object of the study as sweet corn variety "Zamin", "Megaton $F_1$" hybrid, planting dates (April 20, May 1, May 10) were obtained.
In the experiment, seeds of sweet corn varieties and hybrids were sown in 70 x 30 cm plots in 4 replicates. The area of 1 plot for each variety and hybrid was 42 $m^2$, the area of 4 replicates was 168 $m^2$, the total area of the experiment was 1008 $m^2$.
Humus content of the soil in the experimental field (%) according to Tyurin method, total nitrogen, phosphorus and potassium (%) according to Maltsev-Gritsenko, N-$NO_3$ (mg/kg) according to Grandwald-Lyaju method, mobile phosphorus B.P.Machigin and exchangeable potassium P. According to the method of V. Protasov (mg/kg), the soil environment (pH) was determined by the potentiometric method in water absorption [10-15].

In the field experiments, phenological observations were made, in which the field germination of seeds, the complete appearance of plant grass, the formation of the 7th leaf, budding, flowering of the bud, cobbing, milk ripening, wax ripening, etc. were determined [4-6].
In the experiment, biometric measurements were performed on 10 plants in each cultivar and hybrid, and in each selection of variants and replicates. Plant height, height of the 1st and 2nd cobs, number of side cobs, number of leaves on the main stalk, number of joints on the main stalk, number of cobs on one cob, wet and dry weight of the underground and above-ground parts, and root size (in a volumetric container) determined ) determined [7].
In the experiment, when determining the productivity indicators, the yield of commodity cobs, the average weight of one cob, the number of grain rows in an cob, the number of grains in one row of an cob, the length of the 1st and 2nd cobs, the cob diameter and the cob quality indicators of grain (dry matter, sugar, protein, starch) were determined. Cob grain quality indicators based on analyzes of modern laboratory equipment "Granolyser". was determined. The amount of sugar during the cold period of the cob, i.e. during the milk-wax ripening period, was determined by the ATAGO PAL-1 refractometer manufactured in Japan.
Of the selected varieties and hybrids, when grown for different periods and different mulching materials, were statistically analyzed by the method of dispersion analysis according to B.A. Dospekhov [2].

## 3 Results and discussion

The climate of the Republic of Karakalpakstan is sharply continental, the soils are of varying degrees of salinity, and the varieties of sweet corn "Zamin" and "Megaton $F_1$" were separated according to their suitability for growing in these conditions. phenological observations and biometric measurements were carried out in the module plants, which were planted in different periods and in different mulching materials, and the hybrids were planted in the next crop.
The sweet corn variety "Zamin" was sown for the first time on April 20, germination was recorded on the 9th day after planting for variants and replicates. In the second and third periods, that is, on May 1 and May 10, germination was recorded on the 8th day. Germination of seedlings was observed in "Megaton $F_1$" hybrid in 10 days when planted on April 20, in 9 days when planted on May 1, and in 8 days when planted on May 10. Sweet corn seeds germinated relatively quickly as the planting date was delayed, which was definitely related to soil temperature.
The sweet corn variety "Zamin" and the hybrid "Megaton $F_1$" occurred in 13-15 days according to the variant and repetitions. The interval from the formation of the 7th leaf to fertilization lasted 32-33 days. In sweet corn varieties and hybrids, according to all variants and repetitions, the period of flowering and flowering of the cob was 4-5 days, the flowering and ripening of the cob was 13-14 days, the period of ripening - milk ripening was 13-14 days, the period of milk ripening and wax ripening was 4-5 days.
In general, when sweet corn variety "Zamin" and hybrid "Megaton $F_1$" were planted at different times, the vegetation period of the corn until milk-wax ripening was 80-84 days according to variants and repetitions. It was observed that the vegetation period of sweet corn varieties and hybrids was extended by 3-4 days depending on the sowing period. When the variety "Zamin" was planted on April 20 in the first planting period, the growing period was extended by 3 days compared to May 10, that is, when it was planted in the 3rd planting period. The growth period was not significantly different when compared with the control variant, planted on May 10.
Megaton $F_1$ in the case of the hybrid, the duration of planting had an effect on the vegetation period of the plants, the vegetation period was extended to 84 days in the first period, and it

was 81 days in the third period when it was planted on May 10. In the experiment, the vegetation period was 82 days in the control variant planted on May 1.

"Zamin" variety of sweet corn and "Megaton $F_1$" when the hybrid was planted and grown at different times, the plant height was 161.0-173.3 cm according to the variant and repetitions. In this case, the "Zamin" variety was 168.9 cm tall when planted on May 1, 173.3 cm when planted on April 20, and 167.6 cm when planted on May 10. This indicator, that is, the height of the plant "Megaton $F_1$" when measured in the hybrid, relatively tall plants were recorded when the seeds were sown on April 20 and averaged 163.7 cm, while relatively short plants were recorded in the version planted on May 10 and amounted to 161.0 cm. sweet corn in the growth period (April 20) had a positive effect on its photosynthetic parameters, and it was noted that its height was slightly higher than the control option (May 1).

In the climatic conditions of Karakalpakstan (average annual precipitation of 150-200 mm), the use of natural soil moisture in crop cultivation is of great importance. From this point of view, planting agricultural crops, especially sweet corn, in the growth period (April 20) allows it to use the natural moisture of the soil as much as possible.

From the biometric indicators of sweet corn varieties and hybrids, the height of the formation of the first and second cobs on the main stalk was also studied, and the height of the first cob placement in the "Zamin" variety was 23.8-24.5 cm, depending on the planting period, and the second cob was 23.8-24.5 cm, depending on the planting period. the height of placement on the cob was recorded at 31.0-30.3 cm. This indicator is "Megaton $F_1$" It was also analyzed in the hybrid, where the location of the cobs was relatively high in the "Zamin" variety, and it was noted that the first cob was located at 27.6-28.8 cm, and the second cob was located at a height of 36.9-38.4 cm.

Depending on the planting period, the accumulation of sweet corn cultivars and hybrids differed by variant and replication. When the seeds of the "Zamin" variety were sown on April 20, the number of plants (formation of side cobs) was 2.8 pieces, and the control option (May 1) and the period when the seeds were sown on May 10 were 2.6 pieces. Megaton $F_1$ high level of crowding was not noted in the hybrid. In the experiment, the formation of the number of leaves on the main stalk was recorded from 11.5 to 12.4 pieces for all planting periods. The highest number of cobs in one cob was recorded in the variety "Zamin" when planted on April 20, the average number of varieties and repetitions was 3.6, in the control period (1.05) it was 3.3, and in the period planted on May 10, it was 3.1. did Sweet corn "Megaton $F_1$" in the hybrid, the number of cobs in one cob was formed from 2.1 to 3.0 pieces. In both cultivars and hybrids studied in this experiment, no cobless plants were recorded (Table 1).

In the experiment, when the "Zamin" cultivar was planted at different planting dates, the wet weight of one plant under the ground was from 182.5 to 188.9 g, and the dry weight was from 154.3 to 163.7 g, and the root volume was 179.1. It changed to -187.1 $cm^3$.

The above-ground weight of this variety, i.e., cob and leaf wet and dry weight, measured in the wet and dry state, the wet weight of the cob is 340.4-347.7 g on average according to variants and repetitions , and the dry weight is 289.3-301.3 g, the wet weight of the leaf is 81, 3-88.5 g, and dry weight was 69.1-76.6 g. The number of leaves in one cob was in the range of 24.3-25.7 pieces, and the leaf level was 4616.6-5727.7 $cm^3$.

Megaton $F_1$ when some plant parameters of the hybrid, i.e. underground and above-ground weight were determined, the underground wet weight of one plant was 159.6-166.1 g, and the dry weight was 142.0-151.6 g. The root volume of the plant increased from 156.8 $cm^3$ to 163.9 $cm^3$. In this case, the above-ground wet and dry weight of one cob was determined, the wet weight of the cob was 341.9-348.6 g, the dry weight of the cob was 304.2-318.3 g, the wet weight of the leaf was 73.8-80.5 g, and the dry weight of the leaf was 73.8-80.5 g. weight was 65.7-73.5 g. The number of leaves was 11.7-12.4 pieces, and the area was 3222.2-3731.5 $cm^2$.

**Table 1.** "Zamin" variety of sweet corn and "Megaton $F_1$": the effect of hybrid planting dates on biometric indicators (average, 2018-2020)

| Planting period | Plant height, cm | Cob height, cm | | Clustering (number of side cobs), pcs | Number of leaves on the main stalk, pcs | Number of joints in the main stalk, pcs | Number of cobs in one cob, pcs |
|---|---|---|---|---|---|---|---|
| | | 1st cob | 2nd cob | | | | |
| **"Ground" variety** | | | | | | | |
| April 20 | 173.3 ±15 | 24.5 ±2.3 | 31.0 ±3.0 | 2.8 | 12.1 ±1.2 | 12.4 | 3.6 |
| May 1 (control) | 168.9 ±14 | 23.8 ±2.1 | 30.3 ±2.9 | 2.6 | 11.6 ±1.1 | 11.8 | 3.3 |
| May 10 | 167.6 ±14 | 23.8 ±2.1 | 30.2 ±2.9 | 2.6 | 11.3 ±1.1 | 11.6 | 3.1 |
| **Megaton $F_1$ hybrid** | | | | | | | |
| 20.04 | 163.7 ±14 | 28.8 ±2.6 | 38.4 ±3.6 | 0.8 | 12.0 ±1.2 | 12.3 | 3.0 |
| 1.05 (control) | 162.2 ±13 | 28.0 ±2.4 | 37.5 ± 3.5 | 0.6 | 11.6 ± 1.1 | 11.9 | 2.4 |
| 10.05 | 161.0 ±13 | 27.6 ±2.3 | 36.9 ±3.4 | 0.5 | 11.3 ± 1.1 | 11.4 | 2.1 |

In the experimental options and repetitions of sweet corn planting dates, that is, on April 20, sowing the seeds of varieties and hybrids in the field, the formation of the highest underground and above-ground weight was observed (Table 2).

**Table 2.** Effect of sweet corn planting dates on the formation of cobs in the plant (2018-2020 average).

| Planting periods | Separate product | Average weight of one sow, g | Number of rows of grains in the sheaf, pcs | Number of grains in one row of the grain, pcs |
|---|---|---|---|---|
| **"Ground" variety** | | | | |
| April 20 | 2.1 | 249.0 ± 20.7 | 17.1 ± 1.5 | 39.5 ± 3.2 |
| May 1 (control) | 2.0 | 244.4 ± 19.8 | 16.5 ± 1.3 | 38.3 ± 3.0 |
| May 10 | 1.8 | 241.3 ± 19.1 | 16.2 ± 1.1 | 37.5 ± 2.8 |
| **Megaton $F_1$ hybrid** | | | | |
| April 20 | 2.2 | 252.6 ± 21.2 | 16.7 ± 1.4 | 43.6 ± 3.5 |
| May 1 (control) | 2.1 | 244.8 ± 19.7 | 16.2 ± 1.3 | 42.5 ± 3.2 |
| May 10 | 1.8 | 242.0 ± 19.2 | 15.9 ± 1.1 | 42.1 ± 2.9 |

In the experiment, when determining the productivity indicators of sweet corn, the variety "Zamin" and the hybrid "Megaton $F_1$" were grown at different planting dates, and when the yield of commercial cobs was studied, a higher indicator was noted in the variant planted on April 20 compared to the control, and the average of one cob per plant according to the variant and repetitions Received 2.1 pieces of goods. This indicator was 2.0 pieces in the control version, 1.8 pieces in the period planted on May 10. In the "Megaton $F_1$" hybrid, the output of commercial cobs was formed up to 1.8-2.2 pieces according to the planting period, in which, compared to the control, production of many commercial cobs was recorded on April 20, when the seeds were sown.

One of the parameters determining the productivity of sweet corn is the average weight of one cob, the weight of commercial cobs in the studied varieties and hybrids, according to variants and repetitions, was in the range of 241.3-252.6 g.

The high weight of sorghum was noted mainly during the planting period on April 20, the weight of one sorghum according to variants and repetitions was 249.0-252.6 g, the number of grain rows in the sorghum ranged from 15.9 to 17.1, the number of grains in one row was 37.5 - formed up to 43.6 pieces. In this planting period, the length of the first formed cob was not less than 23.9-25.9 cm, and the length of the second cob was between 20.2 cm and 23.8

cm. The measured diameter of the first cob was 4.4-5.5 cm, and that of the second cob was 4.0-4.4 cm.

2018 data of the experiment, the yield of sweet corn depends on the planting dates, and the lowest yield (9.5 tons/ha) was recorded in the variants and repetitions of the variety "Zamin" planted on May 10. The highest seed yield (10.9 tons/ha) was recorded in the variety and replicates planted on April 20, and it was observed that it was 1.2 tons/ha higher than the control option (9.7 tons/ha).

The highest productivity index was recorded in 2019 when planting the "Zamin" variety at different planting times and 11.1 tons of sorghum was obtained on average per hectare according to the variant and repetitions. Relatively low yield was recorded in 2020 in the years of the experiment, and it was observed that the yield per hectare decreased by 0.5-0.7 tons compared to previous years. This had a negative impact on the harvest due to dry weather and 40% low air humidity during seed formation.

The average yield of sweet corn variety "Zamin" in three years (2018-2020) was 9.2-10.8 tons/ha according to options and repetitions. The analysis of the results of the experiments on planting dates in the "Megaton $F_1$" hybrid showed that the yield per hectare of the options in the years of the experiment was significantly different, increasing from 9.3 tons/ha to 12.0 tons/ha. It was noted that the average yield of these options was 9.6-11.8 tons/ha. In the years of research carried out in the experiment (2018-2020), the highest productivity was observed in the variety "Zamin" and the hybrid "Megaton $F_1$" at the planting date of April 20, and it was taken into account that 10.8-11.8 tons of valuable crops were grown per hectare.

When the experimental options were compared to the control, it was noted that when the "Zamin" variety was planted on April 20, 1.1 t (11.3%) higher yield of corn was obtained per hectare, and in the option planted on May 1, these indicators were less than 0.5 t. In Megaton $F_1$ hybrid, it was observed that 1.3 tons/ha (12.3 %) higher seed yield was formed in the variant planted on April 20 compared to the control variant (May 1) (Figure 1).


**Fig. 1.** Yield of sweet corn varieties and hybrids planted in different planting periods, average 2018-2020.

## 4 Conclusions

The experimental data gathered from different planting periods in the conditions of the Republic of Karakalpakstan (2018-2020) provides valuable insights into the cultivation of the "Zamin" variety and the Megaton F1 hybrid of sweet corn. The average yields observed during the study showcase the impact of varying planting times on corn production.

For the "Zamin" variety, the average corn yield ranged from 9.2 to 10.8 tons per hectare across different planting periods (April 20, May 1 and May 10). Similarly, the Megaton F1 hybrid exhibited average yields between 9.6 and 11.8 tons per hectare. The comparison reveals that both varieties demonstrate robust yields, reflecting their adaptability to the environmental conditions of Karakalpakstan.

Remarkably, the highest seed yields were recorded for both the "Zamin" variety and the Megaton F1 hybrid when planted on April 20. The average yield in this variant ranged from 10.8 to 11.8 tons per hectare. In contrast, the control variant, planted on May 1, showed a yield of 9.7 tons per hectare, indicating a difference of 1.1 tons per hectare or an 11.3% increase in the "Zamin" variety. For the Megaton F1 hybrid, the yield was 11.1 tons per hectare, reflecting a 1.3-ton increase or a 12.3% improvement compared to the control variant. These findings underscore the significance of planting timing in optimizing corn yields in the specific agro-climatic conditions of Karakalpakstan. The results suggest that early planting, particularly on April 20, contributes to higher seed yields for both the "Zamin" variety and the Megaton F1 hybrid, providing practical insights for local farmers to enhance the efficiency of sweet corn cultivation in the region.

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