Cultivation of vegetable (sweet) corn varieties and hybrids as repeated crops in Bukhara

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Abstract: 12 varieties and hybrids of vegetable (sweet) corn were grown as repeated crops in medium saline meadow alluvial soils of Bukhara region, and varieties and hybrids such as Zamin, Mazza, Megaton F1, Union F1 were distinguished according to their suitability for cultivation in these soil-climatic conditions. When the separated varieties and hybrids were planted in 3 periods and 6 planting schemes, it was found that the optimal planting scheme was 60x30 and 70x25 cm schemes, and the optimal planting period was July 5. On July 5, 60x30 and 70x25 cm plots of varieties and hybrids suitable for growing in the soil and climate conditions of Bukhara region were planted, and 10.1-14.4 tons of vegetables were harvested. Keywords. Vegetable, (sweet) corn, growing season, plant height, side stem, variety, hybrid, milk maturity, cob weight, yield.

1 Introduction

Among food crops, vegetable (sweet) corn grain ranks first among vegetables in terms of energy calories, one kg of its grain contains 857 calories, 323 calories in green peas, 332 calories in cauliflower [1-11]. Vegetable (sweet) corn contains 4-17% protein, 12-30% starch, 5-17% sugar, 1.2-1.9% oil, 19-24% carbohydrate, 10-23% dextrin. The grain of vegetable (sweet) corn contains a large amount of protein, carbohydrates, fat and vitamins during the ripening period, so it is widely used as a valuable raw material in the food industry. Vegetable (sweet) corn soup is canned, boiled, and sometimes buried in a pot [12, 13].

According to the origin of vegetable (sweet) corn, its homeland is Mexico. The earliest information about vegetable (sweet) corn was found when excavations were carried out in the caves where the indigenous people of the state of Mexico lived in ancient times. According to similar data, the homeland of vegetable (sweet) corn is Central America and Mexico [8,10]. According to some sources, the first selection of vegetable (sweet) corn was carried out by the Peruvian Hundus, and by crossing different varieties of corn, they created varieties similar to the varieties grown today. The first information about vegetable (sweet)

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corn dates back to 1779 and it was named Zea Mays ssp.saccharata and it was cultivated in 1820 [6,8,13].

Vegetable (sweet) corn was first grown from Mexico to Chile, Peru and Bolivia in South America, and then spread to the United States of America and Canada in North America. By the end of the 20th century, vegetable (sweet) corn was intensively grown on large areas in the Commonwealth of Independent States. The United States is the leading producer and consumer of vegetable (sweet) corn. Excessive consumption of vegetable (sweet) corn in the United States of America has made it a national product [2, 7, 5, 9].

In world agriculture, vegetable (sweet) corn is planted on an area of 1,870 million hectares, with an average yield of 9.6-15.8 tons per hectare [10]. Short-term technicalization of vegetable (sweet) corn sorghum allows to grow it as a main and repeated crop in one year. Therefore, the development of agro-technologies for the selection of newly created varieties and hybrids of vegetable (sweet) corn according to their suitability for different soil and climatic conditions, planting period, planting scheme, and cultivation is of great importance.

2 Research object and method

The climate of the Bukhara region, where the research was conducted, is highly variable, and the average air temperature during the year is +14.2 °C; +18.0 °C. The hottest air temperature is observed in July of the year with an average of +28.3 °C; +29.6 °C, and the cooling of the temperature was recorded in January, the air temperature was +1.5 °C; 0.4 °C. Atmospheric precipitation is on average 114-205 mm, and precipitation mainly falls on the winter-spring seasons [3]. The average air humidity is 51-55%, and on average 17-25% in summer.

Our main field experiments were conducted during 2018-2021 in conditions of meadow alluvial soils of Bukhara district. The average amount of humus in the arable layer (0-30 cm) of the soils distributed in this district is 1.20%, and in the sub-arable layer (30-50 cm) is on average 0.56%, total nitrogen is 0.092-0.051%, phosphorus is 0.24-0, 16%, potassium 1.56-1.03%, mobile nitrogen 14.61-7.52 mg/kg, mobile phosphorus 31.26-23.21 mg/kg, mobile potassium and it was 240.41-170.31 mg/kg, and it was observed that it decreased relatively.

The purpose of our research is to select varieties and hybrids suitable for growing vegetable (sweet) corn as a repeated crop in the soil and climate conditions of Bukhara region, to develop the technology of cultivation based on the selection of convenient planting period and schemes.

In order to realize the research goal mentioned above, the following tasks were defined. Selection of promising varieties and hybrids of vegetables (sweet corn) suitable for growing as a repeated crop in medium saline meadow alluvial soils of Bukhara region, as well as determination of favorable planting periods, optimal planting schemes, feeding area, and harvesting periods for obtaining high yield.

As an object of research, seeds of varieties and hybrids of vegetable (sweet) corn such as Mazza, Zamin, Erika, Sherzod, Megaton F1, Tsentnel F1, SF 201 F1, Landmark F1, Union F1, Svin star F1, Monte F1, Candy F1, 3 plantings term, 6 planting schemes served.

The vegetable (sweet) corn varieties and hybrids studied in our research were planted in a 60×25 cm, 10 m long, 2-row planting pattern. The total area of the field experiment for testing varieties and hybrids was 156 m2. 2 varieties and 2 hybrids separated by their suitability for growing in repeated crops in the soil and climatic conditions of Bukhara region were studied in 3 planting periods and 6 planting schemes in summer. Experiments on planting periods and planting schemes were carried out in 4 plots, the area of one plot in

the planting scheme of 60 cm between the rows was 24 m2, and the area of one plot was 28 m2 when the row spacing was 70 cm, and the total area of field experiments was 7488 m2.

In the years of research, the soil of the experimental field was analyzed by agrochemical methods. Also, the amount of humus in the soil (%) according to the Tyurin method, total nitrogen, phosphorus and potassium (%) according to Maltsev-Gritsenko, N-NO3 (mg/kg) in FEK according to the Grandwald-Lyaju method, mobile phosphorus B.P. Machigin and exchangeable potassium According to the method of P.V. Protasov (mg/kg), the soil environment (pN) was determined by the potentiometric method in aqueous absorption [7].

In our research, phenological observations (field germination of seeds, complete emergence of plant grass, formation of the 7th leaf, budding, budding, budding, milk ripening, wax ripening) and biometric measurements (plant height, height of the 1st and 2nd buds, lateral stems) number, the number of leaves on the main stem, the number of joint intervals on the main stem, the number of stalks in one bush, the wet and dry weight of the above-ground and above-ground parts, and the volume of the root) were determined [1,7]. Productivity indicators were statistically analyzed by the method of dispersion analysis according to B.A. Dospekhov [4].

3 Analysis and results

In our experiments to evaluate the suitability of varieties and hybrids of vegetable (sweet) corn for growing as a repeated crop, seeds were sown in the field on July 1 in a 60x25 cm scheme.

According to scientific sources, vegetable (sweet) corn seeds germinate after absorbing 44% of moisture by grain weight [5]. Also, varieties and hybrids of vegetable (sweet) corn are fully ripened in 115 to 186 days, depending on the variety, when the average temperature is above 15 °C. Due to the fact that vegetable (sweet) corn stalks are used for consumption as vegetables, 75-80 days to 100-105 days are enough for its technical ripening.

Germination of sown seeds in varieties and hybrids mainly occurred on July 6-8, that is, on the 6-8th day after sowing. Relatively early germination was recorded on July 6 in the Zamin variety and the Union F1 hybrid. The latest germination was recorded on July 8 in hybrids such as Swin star F1, SF 201 F1, Megaton F1. In the formation of chinbargs, as well as in germination, the regularity was preserved, and the earliest chinbargs were formed in such varieties and hybrids as Zamin, Mazza, Sherzod, Union F1, Candy F1.

Fertilization in all studied varieties and hybrids was recorded mainly on July 26-30. The formation of pods was observed earlier in varieties and hybrids such as Zamin, Sherzod, Union F1, and relatively later in varieties and hybrids such as Svin star F1, SF 201 F1, Megaton F1, mostly on 5-8 days of August. In the experiment, when milk and wax ripening of sows was studied, the fastest sow ripening was observed in Zamin, Sherzod, Union F1 in the second ten days of September, and in the other varieties in the third ten days of September, it was recorded 8-10 days later.

Tajribada biometrik o‘lchovlarga ko‘ra eng baland bo‘yli o‘simliklar asosan Union F1 (230,4 sm), Svin star F1 (183,4 sm), Sentinel F1(187,2 sm) kabilarda qayd etildi.

The placement of the first stem, i.e. height between varieties and hybrids, was 26.2 - 53.7 cm, the number of leaves on the main stem was 10.6 - 13.2, and the number of joints was 9,6 - 12.1.

Scientists who have conducted research on the cultivation of vegetable (sweet) corn say that the technical development of corn corresponds to the period of transition from milk ripening to wax ripening. Since the vegetable (sweet) corn plant is compact, 4-6 good-sized cobs weighing from 150 g to 300 g were obtained from each bush [4].

Also, in our experiments, the highest result on the formation of pods per plant was observed in varieties Eureka (2.1 pcs.), Mazza (2.2 pcs.), Sherzod (4.2 pcs.) and Zamin (4.3 pcs.).

Today, the volume of fresh supply of vegetable (sweet) corn soup by farmers to markets and processing enterprises is increasing day by day, the process of canning or freezing vegetable (sweet) corn soup and grain by processing enterprises is gaining momentum. This requires further increase of productivity indicators in varieties and hybrids of vegetable (sweet) corn. The weight of one cob was recorded from 231.1 to 303.4 grams in the varieties and hybrids of vegetable (sweet) corn studied in the experiment. The highest weight of seeds was recorded in the hybrid Candy F1 (303.4 grams). The number of grain rows in the cob is 14.8 - 20.1 rows, and the highest number of grain rows was recorded in the Candy F1 hybrid. The number of grains in one row of varieties and hybrids was 36.8 - 43.6 grains, the number of grains in one grain was 398.9 - 522.7 grains, the weight of grains in one grain was 190.6 - 292.2 grams.

The weight of the kernel in the sorghum varied from 61.1 to 101.6 grams, and the yield of wet grain from the sorghum was recorded from 59.9 to 65.8%.

The highest index of wet grain yield was observed in varieties and hybrids such as Zamin, Sherzod, Union F1, Sentinel F1.

The mass yield of inter-variety and hybrid silage was 26.2-31.3 tons per hectare, and the yield of silage was 8.3-12.4 tons per hectare.

observed. The highest seed yield was recorded in varieties and hybrids such as Zamin (11.0 tons), Megaton F1 (11.8 tons), Union F1 (12.4 tons).

The increase in the demand for vegetable (sweet) corn syrup is due to its high-quality biochemical composition, and since corn canning or freezing is highly profitable in processing, they are also increasing the volume of processing of this product every day [8].

In our research, the biochemical composition of hybrids of vegetable (sweet) corn was analyzed. The dry matter was recorded from 29.0 to 32.9%, and the highest accumulation of dry matter was observed in varieties and hybrids such as Zamin, Megaton F1, Sentinel F1, Candy F1. When these varieties and hybrids were tasted and evaluated, their tasting score was estimated from 6.6 to 9.5 points.

Table 1. Productivity of vegetable (sweet) corn varieties and hybrids

№	Name of variety and hybrid	Productivity by years, t/ha			Average
		2019	2020	2021	
1.	Taste (control)	9,5±1,3	10,1±1,4	9,2±1,3	9,6±1,4
2.	Zamin	10,3±1,4	9,7±1,4	10,0±1,4	10,0±1,4
3.	Evrika	9,4±1,3	9,2±1,3	9,6±1,4	9,4±1,3
4.	Sherzod	9,7±1,4	10,1±1,4	9,3±1,3	9,7±1,4
5.	Svin Star F_1 (control)	9,4±1,0	9,8±1,1	9,0±1,0	9,4±1,0
6.	SF 201 F_1	10,0±1,1	10,3±1,1	9,7±1,1	10,0±1,1
7.	Megaton F_1	12,4±1,4	11,1±1,2	11,9±1,3	11,8±1,3
8.	Sentinel F_1	9,8±1,1	10,1±1,1	9,5±1,0	9,8±1,1
9.	Lendmark F_1	7,9±0,9	8,3±0,9	7,5±0,8	7,9±0,9
10.	Monte F_1	8,8±1,0	9,5±1,0	9,3±1,0	9,2±1,0
11.	Union F_1	11,8±1,3	12,4±1,4	13,0±1,4	12,4±1,4
12.	Candy	10,0±1,1	10,4±1,1	9,6±1,1	10,0±1,1
$EKIF_{05}$		1,50	1,66	1,84	
Sx%		5,26	5,69	6,52	

Average vegetable (sweet) corn cultivars and hybrids are valuable signs as vegetables related to the content of sugar content. When this indicator was determined during the milk wax ripening period, it was observed that 5.8-12.8% of sugar was stored in the wet grain. The highest index of sugar content was recorded in varieties and hybrids such as Mazza, Sherzod, Zamin, Megaton F1, Sentinel F1, Candy F1.

By the time of full ripening of the grains in the vegetable (sweet) corn sauce, the amount of sugar in the grain decreased to 1.8-3.3%. Also, the protein content of the grain was 2.13-2.96%, and the fiber content was 0.26-0.56%. In general, it was found in our experiments that sweet corn stalks lose their edibility as a vegetable if they are not harvested at the time of milk-wax ripening.

The yield of vegetable (sweet) corn is related to the planting scheme and the number of plants per hectare. Another element of intensive technologies in the cultivation of corn is the dense planting of seeds. Corn seeding density has a significant effect on plant vegetation and length of growing season and growth rate. When growing vegetable (sweet) corn varieties and hybrids, the correct determination of their planting thickness increases the yield of cobs and stalks by 20-30% [9,11].

Among the sweet corn varieties and hybrids studied in our research, the varieties and hybrids Zamin, Mazza, Megaton F1, Union F1, which provided the highest wet grain yield, were selected in the soil and climate conditions of Bukhara region in 3 periods (25.06; 05.07; 15.07) and 6 It was grown in a planting pattern (60x20; 60x25; 60x30; 70x20; 70x25; 70x30;) and 1 optimal planting period (05.07) and 2 optimal planting patterns (60x30; 70x25;) were determined. In this case, phenological observations and biometric measurements showed that, when selected varieties and hybrids of sweet corn were planted on July 5, germination was 7 - 8 days for replicates, and did not differ sharply between planting schemes.

Relatively early germination between varieties and hybrids was noted in the Zamin variety and the Union F1 hybrid. The seeds of the Megaton F1 hybrid and the Mazza variety germinated relatively late. In our experiments, the regularity of sprouting was preserved in the formation of cypresses according to repetitions. First, it was recorded in Zamin, Mazza, Union F1, and then in the Megaton F1 hybrid.

In the sweet corn varieties and hybrids studied in our experiments, fruiting was recorded mainly on August 5-8, and fruiting significantly differed depending on the sowing period and planting scheme. That is, as the planting scheme was shortened, it was shown that the flowering period of sweet corn plants was also accelerated.

In all studied cultivars and hybrids, regardless of the planting period, it was statistically proven that the mass of a single plant increased with the expansion of the feeding area. The relationship between these indicators is strong ($r>0.7$), linear in expression and direction, and the regression equation is generally obeyed by $y=a+bx$.

At the same time, in our experiments, the influence of planting schemes on the formation of pods was observed. When the planting schemes were shortened and plants were planted densely, the second and third pods were not fully formed, or even when formed, grain rows were incomplete and small unproductive pods were formed. It has been proved mathematically and statistically that the height of the first row depends on the area of plant nutrition, the biological characteristics of varieties and hybrids. In Mazza and Zamin varieties, in the Union F1 hybrid, it was found that as the feeding area of the plants increases, the first shoot is lower. In all cases, it was found that the relationship is strong ($r>0.7$), and in turn, there is an inverse relationship. It was taken into account that only the Megaton F1 hybrid does not obey this rule when the row spacing is 70 cm. When the studied varieties and hybrids of sweet corn are grown as a repeated crop in the scheme of 60x30 and 70x25 cm, the length of the stalk according to the repetitions is 24.1 - 26.2; 24.4 - 26.8 cm, diameter of the stem 4.9 - 5.8; 5.0 - 5.9 cm, the number of rows of grain in the

circle of the soot is 15.7 - 21.2; 15.8 - 22.1 rows, the number of grains in one row is 38.7 - 46.2; 39.0 - 46.9

The vegetable (sweet) corn grown as a repeated crop was analyzed according to productivity indicators, in which the wet weight of one cob between varieties and hybrids was 327.6 -363.0 grams for all variants and repetitions.

According to each variant and repetition, when it was determined whether the milk-wax ripening period of wet grain was released from the sow, it was noted that this indicator was in the Mazza variety 247.8 - 251.0 g or 64.6 - 65.9%, in the Zamin variety 255.5 - 263, 7 g or 67.2 - 69.9 %, 282.1 - 283.5 g or 67.0 - 69.1 % in the Union F1 hybrid, 255.3 - 255.7 g or 65.6 - 67 in the Megaton F1 hybrid, 7%

In the experiment, when the dependence of the grain weight in the first cob on different planting periods was analyzed, it was noted that the grain weight in the cob varied in varieties and hybrids.

An inverse parabolic relationship was observed between these parameters for the ground variety and the Megaton F1 hybrid, while both parabolic and inverse parabolic relationships were found for the Mazza variety and the Union F1 hybrid. It can be concluded that Mazza variety and Union F1 hybrid show a sharp change in the weight of grains in the field depending on the nutritional area, i.e. the use of water, nutrients and light by the plants.

The yield of vegetable (sweet) corn is related to the planting scheme and the number of plants per hectare. Another element of intensive technologies in the cultivation of corn is the dense planting of seeds. Corn seeding density has a significant effect on plant vegetation and length of growing season and growth rate. When growing vegetable (sweet) corn varieties and hybrids, the correct determination of their planting thickness increases the yield of cobs and stalks by 20-30%.

In general, it is necessary to plant sweet corn in rows in a repeated crop and ensure that there are 57-70 thousand plants per hectare. However, if the number of bushes per hectare increases, the grain yield will decrease.

According to the analysis of planting schemes in different planting periods, that is, grain yield depending on the feeding area, the grain yield in all studied varieties and hybrids, in the variants planted in a scheme with 60 cm between the rows, the increase in grain yield with the expansion of the feeding area has a straight linear relationship (y=a+ bx), and in schemes with 70 cm between rows, a decrease in productivity was found when the feeding area was large (70x30 cm). It was noted that the relationship is curvilinear, that is, in the form of an inverted parabola (y=a+bx-cx2), and in both cases the relationship is strong (r>0.7).

In our experiments, the yield of sweet corn varieties and hybrids grown as a repeated crop depends on the planting scheme in options and repetitions, and it was observed that it increased on average to 14.2 - 19.8 tons in the 60x30 cm plot, and to 14.8 - 20.7 tons in the 70x25 cm plot, and the most high blue stem productivity was recorded in the Union F1 hybrid and was 19.8 - 20.7 tons per hectare.

In the conditions of irrigated (saline) meadow alluvial soils of Bukhara region, as a repeated crop, varieties and hybrids of vegetable (sweet) corn are grown in different periods and planting schemes, according to options and repetitions, the yield of corn during the milk-wax ripening period is 8.3-12.4 t/ha on average. organized. In this case, the highest seed productivity indicator was observed when planting in the 60x30 and 70x25 cm schemes on July 5, according to variants and repetitions, 10.4 - 11.2 tons in the Zamin variety, 10.1 - 10.7 tons in the Mazza variety, 12.6 - 13 in the Megaton F1 hybrid. 5 tons, in the Union F1 hybrid it was 13.6 - 14.4 tons.

3 Conclusion

Varieties and hybrids of vegetable (sweet) corn, such as Zamin, Mazza, Megaton F1, Union F1, are planted as a repeated crop in 60x30 and 70x25 cm schemes in the conditions of moderately saline meadow alluvial soils of the Bukhara region in the period of July 5, 10.1-14.4 tons of vegetables per hectare. while ensuring the cultivation of soybean crops.

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