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A Research on to Effective on Yield and Earliness of Different Sowing Times and Growing Techniques in Sweet Corn (Zea mays saccarata Sturts) in Kahramanmaraş Conditions

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Abstract

In order to investigate the effect of different sowing times and growing techniques. On yield and earliness of two sweet corn varieties, this study, was done in Kahramanmaraş conditions in 1997 – 1998 growing years. Kahramanmaraş research station conditions. Field trials arranged in split – split plot design with there replications, varieties sowing times and growing techniques were used an as main, sub and sub – sub plots, respectively. In this study, Merit and Jubilee varieties used as sweet corn varieties.

According to result obtained from the experiment interm of starch ration, number of grain per ear and number of plant per unit Merit variety was found to be superior but interm of days two maturity ear lenght Jubilee was superior. It was determined that earliness sweet corn growing was possible by using covered growing techniques on that covered growing techniques possitively influenced the all characteristic studied starch ratio and ear lenght. Effect of sowing times on days the maturity wasn't significant. If the temperature is low plant adapted itself till the temperature research optimum. But days the maturity increased vice verse decreased. The optimum sowing times for the Kahramanmaraş conditions was 30 March.

Keywords

Sweet corn (Zea mays saccarata Sturts), sowing dates, growing techniques

1. INTRODUCTION

We are in the century where agricultural research will become more important every day. In the last three centuries people have exploited the natural resources irresponsibly by the development of industry and technology. This exploitation is unfortunately still going on. The inexhaustible performance of the western countries, especially in the hands of technology, has brought the whole world to a catastrophic threshold. At the current point, they are talked which about issue such as global warming, decline of biological diversity, climate change than incresing productivity. Until today, it was tried to fulfill the cultivation of forest and grassland for food needs with the help of agriculture. Even if these processes are continued in some parts of the world, it is

also stated that the places that were opened as farming areas in the past, should be abandoned in favor of forest and grassland, according to some researchers, even to the end of new fields to be opened. We understand from this information that the new field areas is no longer in the world. It is then necessary to obtain high efficiency from the unit side in order for the feeding population. Research should develop in this direction. In other words, it is essential to produce more in both quantities and varieties from unit area during the breeding period. For this purpose, many methods of cultivating and renewing crops such as co-cultivation, intercropping, sliver cultivation, sub-cropping, cover cropping and mixed cultivation are carried out in many parts of the World (1).

It is directly related to the genetic structure of plant production material, soil characteristics and climate movements. Climate conditions play the most important role in the selection of crops to be cultivated in a region (2). Light, temperature, day length and precipitation are the most important factors (3). Temperature is one of the most important issues with the transport of photosynthesis, the determination of the developmental periods and especially the effect of filling the grains (4).

As the seeds of corn are used as feed for human beings and pulp as well as the sugar corn types for fresh consumption, the market value can be two or three times higher when they are introduced to the first market. Therefore, it is extremely important for economic reasons to be able to produce as early as possible. In order to increased productivity and earliness in production, unveiled agriculture technique has emerged in recent years (5, 6,7,8).

The main factor limiting early planting in corn is temperature. Early seeding is possible when the temperature environment required for corn is provided. Early planting can be done by creating low tunnels. In sugar corn which can be obtained earliness for 10 - 21 days according to common sowing method (8,9,10,11).

Polyculture farming can be done easily in the large lands of Kahramanmaras in Mediterranean climate. Many of the plants can continue their development if the necessary environment can be prepared in terms of temperature even from February to March. Plant seedling and low tunnel applications will make it possible to make more efficient farming with earliness.

Figure 1. General view of research area

This study was carried out to investigate the effects of different sowing times and growing techniques on yield and earliness of sugar corn in Kahramanmaraş conditions.

2. MATERIAL AND METHOD

2.1. Material

2.1.1. Used material in experimental area

In the study, jubile and merit sugar corn varieties which are suitable for region conditions were used. Seeds are germinated in small nylon tubes. Mixed soils were used to germinate seeds. Pure nitrogen was used at 20 kg / da. 10 kg / da ammonium nitrate (A.N.) was used as fertilizer and 10 kg / da was used as urea as top fertilizer.

2.1.2. Soil characteristics of experimental area

Some physical and chemical analysis characteristics experimental area soil which in taken from 0-30 cm depth are given in Table 1.

Table 1. Some physical and chemical analysis characteristics of experimental area

Depth	Tekstur class	Ph	Lime (%)	Convenient P (P^2O^5)	Organic matter (%)	Saturation with water (%)
0-30 cm	Clay - loamy	7.50	20.24	5.9	0.95	54

*Soil analysis, K.S.Ü Agricultural Faculty Soil Department laboratory

2.1.3. Climatic properties of experimental area

The climate data for Kahramanmaras province between March and July 1997, 1998 and long years are given in the Table - 2. According to the table, the highest and lowest temperature values for March and April were unusual for many years. Rainfall totals differed in April and May.

Table 2. Climatic datas of March – July months in Kahramanmaraş province

Months	Minimum temperature (°C)	Maximum temperature (°C)	Average temperature (°C)	Proportional humidity (%)	Total precipitation (mm)
March	3.4	13.4	6.2	53.3	46.8
1997	4.6	14.5	4.9	61.0	134.0
	-6.0	25.6	10.4	63.2	90.4
1998					
Long years average					
April	6.2	17.3	12.0	62.5	105.3
1997	10.8	22.4	16.6	57.8	166.7
	-1.8	32.6	14.9	69.8	68.7
1998					
Long years average					
May	15.0	28.7	21.7	55.1	88.2
1997	14.3	25.7	19.8	57.0	39.4
	15.4	36.3	19.9	55.5	35.0
1998					
Long years average					
June	18.4	31.6	24.6	51.4	14.9
1997	19.5	33.4	25.9	54.9	15.6
	20.3	39.6	24.3	49.5	7.0
1998					
Long years average					
July 1997	22.3	34.5	27.6	48.6	-
1998	23.1	44.3	29.8	55.6	2.0
Long years average	16.4	41.6	27.8	51.7	3.0

* Kahramanmaraş meteorological station 1997, 1998 years with (1940 – 1990) long years average datas.

2.2. Method

2.2.1. Experimental Method

This research was carried out on Kahramanmaras Agricultural Research Center Provincial Directorate. The trials were established in March and July 1997 and 1998. In the experiment, three different times (March 15, March 30 and April 15) were planted seedling on the tubes, seedling under cover and seeding techniques in open field. To cover the plots, a low tunnel roof was made of thin construction iron and covered with transparent plastic linoleum (*Figure 2*). The trial was established according to divided into three divided trials plan. Varieties were formed in the main parcels, planting times in the sub - parcels, and cultivating techniques in the sub – sub parcels. The planting distances of the plants were determined as 70 cm x 20 cm the rows, and the parcel area (sub-bottom) was 5 × 24 = 12 m2, with each parcel being in 5 m lenght and in 2.4 m width. Closed parcels were opened and ventilated opening in sunny times by following the temperature condition of the air and fully opened towards the end of April.

Figure 2. Low tunnel in used experimental area

2.2.2. Investigated properties in experimental

In this study were investigated properties as ear lenght, ear diameter, number of grain per ear, number of plant per unit, number of ear per unit, ratio and starch ratio. While the Polarimeter method was used for Starch analysis in the laboratories of the Faculty of Agriculture, the other characteristics were determined in the 10 samples of plants obtained from each plot. Statistical analyzes of the obtained datas were calculated on the MSTATC package program.

Figure 3. Outlook of two different applications in experiement.

3. RESULT AND DISCUSSION

3.1. Ear lenght (cm)

The mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the ear lenght were given in *Table 3.*

Table 3 Two-year mean values indicating the effect on the ear lenght of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	18.0^{ef}	19.3^{abcde}	18.8^{abcdef}	18.7^{b}
Covered seed	19.1^{abcde}	18.5^{bcdef}	18.1^{ef}	18.6^{b}
Normal sowing	19.9^{abc}	19.3^{abcde}	19.4^{abcde}	19.6^{a}
ç x e.z	19.0	19.0	18.8	**18.9**
Growing techniques	Jubile			
	15 march	30 march	15 april	c x g.t
Covered plant	18.7^{abcdef}	17.5^{f}	18.6^{bcdef}	18.2^{b}
Covered seed	18.4^{def}	19.6^{abcd}	20.1^{a}	19.4^{a}
Normal sowing	18.5^{bcdef}	20.0^{ab}	20.0^{abc}	19.5^{a}
c x s.t	18.5^{b}	19.0^{ab}	19.5^{a}	**19.0**
LSD	g.t (%1):0.6070; c x g.t (%5):0.6435; cx s.t x g.t (%1):1.487			

c: cultivar, g.t: growing techniques, s.t: sowing time

According to the table, in the merit coltivar, the c x s.t interaction is not significant, whereas the highest ear lenght (19.0 cm) was obtained from 15 and 30 March sowings.

While the c x g.t interactions of the Merit cultivar was important, the highest value of the study, which was found in the merit cultivar from normal cultivation as 19.6 cm(14). In the jubilee cultivar, the c x s.t interactions were significant (15), while the highest ear lenght was obtained as 19.5 cm in the April 15 plantations. In the jubilee cultivar, the value of the obtained ear lenght was obtained as 19.5 cm from the normal sowing while it was important in the c x g.t. The interactions c x s.t x g.t between the Merit and the jubilee cultivars were not important.

Figure 4. Ear lenght of jübile cultivar

Although the difference is insignificant, the highest ear lenght was obtained from the jubilee cultivar as 19 cm. As can be seen from the values, higher ear lenght was obtained from normal cultivation according to the other cultivation techniques. These results seem to be consistent with studies that indicate that the ear length is higher in normal sowing than in other techniques (12), and that the ear lenght is lower in the plant seedling techniques(13). When sowing time is considered, the time of sowing in merit cultivar was not important but

the ear lenght was decreasing, it has increased in the jubilee cultivar. It can be said that this is a cultivar feature, and that the cultivar of jubilee is generally longer than the ear lenght of cultivar merit (14).

3.2. Ear diameter (cm)

In *Table 4* was shown the mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the ear diameter. When the Table 4 is examined, it is possible to observe that the ear diameter was smaller as the sowing time was delayed, although there was no statistical significance among the factors.

Table – 4. Two-year mean values indicating the effect on the ear diameter of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	5.0	4.8	4.8	4.9
Covered seed	5.0	4.9	4.5	4.8
Normal sowing	4.1	4.9	4.5	4.5
c x s.t	4.7	4.9	4.6	**4.7**
Growing techniques	Jubile			
	15 march	30 march	15 april	c x g.t
Covered plant	5.0	4.6	4.6	4.7
Covered seed	5.0	4.5	4.8	4.7
Normal sowing	4.3	4.5	4.5	4.5
c x s.t	4.8	4.5	4.7	**4.7**
LSD	Sowing time: n.s, cultivar: n.s			

c: cultivar, y.t: growing techniques, s.t: sowing time, n.s: no significant

Both the merit and the jubile cultivars were found to have a diameter of 5 cm in the March 15 plantings and a drop of 4.5cm in the April 15 plantings.

According to the cultivation techniques, it is understood that the diameter of the cocoon in normal cultivation (5cm) was thicker than that of covered cultivation (4.1cm). The interactions of cultivar x sowing time x growing techniques were to 4.7cm. It see that the ear diameter was decreasing as the sowing time was delayed, and it seems that the datas werecompatible with similar studies (12,13,17,18). According to the results obtained in our study, it was seen that the cultivation techniques do not have a significant effect on the eardiameter. However, some researchers report that direct sowing forms a thicker ear diameter than other applications (12,13). It can be said that this contrast is made according to the genetic material and ecological regions used in the studies.

3.3. Number of grain per ear

In *Table 5* was shown the mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the number of grain per ear.

It is seen that cultivar, sowing time and growing techniques have a statistically significant effect on the number of grain per ear at 1% level, cultivar x sowing time, cultivar x growing techniques and x cultivation time x growing techniques interactions is significantly at 5% level.

Table – 5. Two-year mean values indicating the effect on the number of grain per ear of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	566.7^{def}	617.9^{abcd}	621.1^{abcd}	601.9^{ab}
Covered seed	640.7^{ab}	630.5^{abc}	570.1^{def}	613.8^{a}
Normal sowing	505.5^{gh}	642.3^{ab}	565.9^{def}	569.6^{bc}
c x s.t	569.3^{b}	630.2^{a}	585.7^{b}	**595.1^{a}**
Growing techniques	Jubile			
	15 march	30 march	15 april	cx g.t
Covered plant	519.7^{fg}	512.6^{fgh}	533.1^{efg}	521.8^{d}
Covered seed	551.2^{efg}	615.0^{abcd}	655.6^{a}	607.3^{a}
Normal sowing	455.7^{h}	572.0^{cdef}	585.2^{bcde}	537.6^{cd}
c x s.t	508.9^{c}	566.5^{b}	591.3^{b}	**555.6^{b}**
LSD	s.t(%1):37.03; c(%1):428.3; cxs.t(%5):38.01; g.t (%1):34.51; cxs.txg.t(%5):59.78; cxg.t(%5):34.51			

c: cultivar, g.t: growing techniques, s.t: sowing time

From the obtained data, according to interactions of c x g.t x s.t , it can be seen that the number of grain per ear obtained in merit cultivar (595.1) is higher than the number of jubilee cultivar (555.6). In the c x g.t interactions, the highest value was obtained as 613.8 per from covered seed application of merit cultivar. It was understood that the application of covered seed in the jubilee cultivar showed the highest value as 607.3 per. It was seen that the highest value was obtained from the March 30 application of the highest the number of grain per ear of merit cultivar in the c x s.t interactions, while the highest value of the jubilee cultivar was found on the 15 April cultivars as 591.3 per. According to these results, it can be said that the most suitable sowing technique is the covered seed technique and the most suitable sowing time is between March 30 and April 15(12). According to the c x e.z x y t interaction, it can be said that the merit cultivar has better values than the jübile cultivar compared to the climate and application conditions (14, 29). This result is consistent with the findings of researchers who say that very genotypic is effective (16,20). In the area where the experiment was established, the March climate values averaged around -6 ° C for the long years and 3.4 - 4.6 ° C for the years when the tests were conducted. Therefore, it is expected that the 15 March applications will not be suitable for the cultivation of corn plants. Minimum temperature requirements for maize plant are 13 - 15 ° C(3).

3.4. Number of plant per unit (per/da)

In *Table6* was given the mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the number of plant per unit. In Table – 6, it can be observed to be effective of year, sowing time, variety, variety x sowing time and growing techniques on number of plant per unit (per/da) at 1% level.

Table – 6. Two-year mean values indicating the effect on the number of plant per unit (per/da) of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	5094.8	4154.5	5761.5	5003.6
Covered seed	3844.6	6904.3	6083.0	5610.6
Normal sowing	1833.1	5.47.5	5499.6	4126.7
c x s.t	3590.8^{d}	5368.7^{ab}	5781.3^{a}	**4913.6^{a}**
Growing techniques	Jubile			
	15 march	30 march	15 april	c x g.t
Covered plant	4844.8	3880.5	5440.0	4721.7
Covered seed	4321.0	4666.3	4487.8	4491.7
Normal sowing	2178.1	4368.6	4333.6	3626.8
c x s.t	3781.3^{d}	4305.1^{cd}	4753.8^{bc}	**4280.1^{b}**
LSD	year(%1):5646.7; s.t(%1):559.4; c(%1):5646.7; cxs.t(%1):791.1; g.t(%1):544.4			

c: cultivar, g.t: growing techniques, s.t: sowing time

While the highest number of plant per unit was obtained as 4913 from the merit cultivar according to c x y.t x e.z interaction, this data could be obtained from the jubile cultivar as 4280.1. According to the c x s.t interaction, The highest value of the Merit cultivar was obtained from the April 15 plantations as5781 pieces, and this value was realized as 4753.8 pieces in the jübile cultivar from the April 15 plantations. According to c x g.t Interaction, the highest number of plant per unit was obtained from covered seed applications, although statistically insignificant in both types. While the number of plant per unit obtained from the Merit cultivar was 5610.6, the number of plant per obtained from the jubile cultivar was 4491.7. The fact that there is no difference between covered sowing and planting shows compatibility with literature studies (12,21). According to the results obtained by experiment, the covered seed application of April 15 plantings of merit cultivar indicates the most efficient application. It can be said that the merit cultivar had different values according to the jubilee cultivar, indicating that genotypes given different responses (23).

As can be seen from Table-6, the number of plants increases in late sowing. This is due to the increase in temperatures. As temperature increases, the germination power of seeds and the germination fidelity increase (21, 22). Sweetcorn varieties are affected by temperatures too much. The opinions of Cross and Zuber (1972), which states that the most useful classification method of temperature-dependent classification is supporting our data(24).

3.5. Number of ear per unit

In *Table 7* was shown the mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the number of ear plant per unit. According to *table 7*, year, cultivar, cultivar x sowing time and growing techniques are effective at 1% level and at 5% level of sowing time on number of ear per unit. The highest number of ear per unit according to c x e.z x y.t interaction was 5269.9 (per/da) from the jubile cultivar. According to the cultivation techniques of the cultivars, it can be said that the most suitable cultivation is covered plant application. The highest number of ear plant per unit from covered plant of March 15 application of Merit cultivar was 6737.8 (per/da). The jubile cultivar also gave the highest yield from the covered plant application. It is also say from datas that more the number of ear plant per unit (per/da) are obtained than covered sowing and planting. It is seen from the literature that these values are compatible with previous studies(25, 11).

Table – 7. Two-year mean values indicating the effect on the number of ear plant per unit (per/da) of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	6737.8^{ab}	5083.0^{de}	5702.0^{bcd}	5840.9
Covered seed	4583.0^{e}	5856.6^{bcd}	5249.6^{cde}	5229.7
Normal sowing	2083.0^{f}	5190.3^{de}	5190.5^{de}	4154.6
c x s.t	4467.9	5376.6	5380.7	**5075.1**
Growing techniques	Jubile			
	15 march	30 march	15 april	c x g.t
Covered plant	6321.1^{abc}	5702.0^{bcd}	7130.8^{a}	6384.6
Covered seed	5497.0^{cde}	4856.6^{de}	4761.6^{de}	5038.4
Normal sowing	2999.8^{f}	5214.0^{cde}	4892.5^{de}	4368.7
c x s.t	4939.3	5257.5	5595.0	**5263.9**
LSD	year(%1):467.80; s.t(%5):520; cxs.txg.t(%1):1109; g.t(%1):452.7			

c: cultivar, g.t: growing techniques, s.t: sowing time

3.6. *Cab ration (%)*

In Table 8 was given mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the cab ratio (%).

Table – 8. Two-year mean values indicating the effect on the cab ratio (%) of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	19.6^{bc}	20.2^{bc}	18.4^{c}	19.4
Covered seed	19.7^{bc}	21.6^{bc}	21.7^{bc}	21.0
Normal sowing	22.6^{b}	20.1^{bc}	22.8^{b}	21.9
c x s.t	20.7	20.6	21.0	**20.8**
Growing techniques	Jubile			
	15 march	30 march	15 april	c x g.t
Covered plant	18.7^{c}	19.6^{bc}	19.9^{bc}	19.4
Covered seed	21.6^{bc}	20.4^{bc}	19.7^{bc}	20.6
Normal sowing	28.5^{a}	22.7^{b}	20.1^{bc}	23.8
c x s.t	22.9	20.9	19.9	**21.2**
LSD	g.t(%1):2.364, cxg.txs.t(%5):3.559			

c: cultivar, g.t: growing techniques, s.t: sowing time

While the effect of growing techniques techniques on the cab ratio was found to be significant at the 1% level, the interactions of c x growing techniques x sowing times techniques appeared to be effective at 5% level. While the cab ratio of the Merit cultivar was determined as 20.8%, this ratio was 21.2% in the jubilee cultivar. According to datas, covered agriculture and early sowing in sweetcorn which cab ratio is be decrease, this state effects to grain yield positively. It is a negative situation that the cab ratio in normal sowing is high. Because it can be said that grain yield decreases in ear of sweetcorn affected by cold (26, 14).

3.7. Starch ratio (%)

In *Table 9* was given the mean values and formed groups of two years (1997 - 1998) showing the effect of cultivar, sowing time and growing techniques on the starch ratio (%). As can be seen from the *table 9*, the highest starch ratio was obtained from the merit cultivar, according to c x g.t x s.t interactions as 54.1% (26). It can be said that the cultivation techniques did not have a statistically significant effect on the starch ratio. The highest starch ratio was found to be 55.9% on 30 March cultivars compared to the cultivar x sowing time interaction. April 15 plantations were in the same group with 54.0%.

Table – 9. Two-year mean values indicating the effect on the starch ratio (%) of cultivar, sowing time and growing techniques used in the experiment.

Growing techniques	Merit			
	15 march	30 march	15 april	c x g.t
Covered plant	52.7	57.3	52.0	54.0
Covered seed	53.0	55.0	54.8	54.2
Normal sowing	51.4	55.4	55.2	54.0
c x s.t	52.4^{bc}	55.9^{a}	54.0^{ab}	**54.1a**
Growing techniques	Jubile			
	15 march	30 march	15 april	c x g.t
Covered plant	53.7	52.0	53.5	53.1
Covered seed	50.2	51.8	54.7	52.0
Normal sowing	51.0	52.5	51.8	51.8
c x s.t	51.6^{c}	51.9^{c}	53.3^{bc}	**52.3b**
LSD	cultivar(%1):15.21, s.t(%5):1.468, cxs.t(%5):2.076			

c: cultivar, g.t: growing techniques, s.t: sowing time

4. CONCLUSION

This study was carried out to investigate the effect of different growing techniques and sowing times on yield and earliness of two sweet corn cultivars. According to result covered seedlings growing techniques provided earlinest and in the years covered seeding and plantings could be performed. It was founded when climatic factors was optimum covered seeding and plantings could be performed between 15 – 30 March. Also founded merit cultivar more adapted than jübile cultivar depth. Also, open seeding is only possible after 30 March. When deciding the proper growing techniques aconomic analysis including addition cost caused by plaastic, seedling procedurs compared to addition income from the earliness should be considered.

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