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Effect of different planting methods on growth, yield and quality of two sweet corn hybrids

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Abstract

Two field experiments were carried out at the Agricultural Experimental Farm, Faculty of Agriculture, Suez Canal University Ismailia Governorate, during the early summer season of 2013 and 2014, to investigate the effect of some planting methods on vegetative growth, yield and ear quality of two sweet corn cultivars. A randomized complete block design in a split plot arrangement with four replications was used. The sweet corn hybrid cultivars (‘Challenger’ and ‘Dynasty’) represented main plots, while planting method treatments (direct seeds under low tunnels, transplants in open field and direct seeds in open field) represented subplots. Growing sweet corn from direct seeds under low tunnels developed plants with greatest values of plant height, plant fresh weight and plant dry weight. The direct seeded planting method had more favorable influence on unhusked ear weight as well as husked weight, length and diameter than seedling rising. The application of low tunnels cover to direct seeded sweet corn plants had clearly positive effect on yield of both husked and nonhusked ears as compared with noncovered direct seeded plants. The planting treatments did not have any significant effect on ear chemical parameters, i.e the percentage of dry matter, TSS%, reducing sugars, nonreducing sugars, total sugars and starch. Conversely, the transplant treatment produced significantly the lowest weights of unhusked and husked ear with lowest diameter and length and had significantly adverse effect on ears yield as compared to the other treatments. Dynsty ’hybrid showed significantly higher values of plant fresh and dry weight and higher percentages of total and non-reducing sugars in sweet corn kernels than ‘Chalenger’, while kernels of ‘Dynsty’ contained higher percentage of starch than those of ‘Chalenger’. Meanwhile, no significant differences were detected between the two sweet corn hybrids in the other characters, i.e., morphological characters of the plants (plant height, number of leaves and stem diameter), all ears morphological characters (husked and unhusked ear weight, length and diameter of ears), yield of both husked ears, and chemical characters of kernels (percentage of dry matter, TSS, reducing sugars, non-reducing sugars).

Key words: Growth; Hybrid cultivars; Planting methods, Ear quality Sweet corn; Yield

Introduction

Sweet corn (*Zea mays* ssp. *saccharata*) is one of the most popular vegetable in the USA and its popularity is increasing in Asia and Europe. In the USA, the farm value of sweet corn for processing ranks second only to tomato. Among vegetables of fresh consumption, sweet corn ranks sixth in the value in the USA. In 2010, the world's top five leading producers were the US (4.120 million MT), Mexico (0.630 million MT), Nigeria (0.579 million MT) France (0.522 million MT) and Hungary (0.519 million MT) (USDA, 2010). For comparison, in the United States and in Western Europe the level of annual consumption is in the range of 10–15 kg per person (Szymanek, et al., 2006).

Sweet corn is distinguished from the other corns by its high sugar content in the milky stage and by its wrinkled translucent kernels when dry. Although consumers enjoy sweet corn for its tender kernels, high sugar concentration and flavor, it can be an excellent source of both Vitamins C and E and some minerals (Makhlouf et al., 1995; Warman and Havard, 1998). Although sweet corn production and consumption has increased sharply in many countries, especially in Europe, it is not known in Egypt. Sweet corn is newly introduced but the information on its production under Egyptian conditions is scarce. Moreover, Egypt has a great chance to export its early sweet corn production to the European countries; therefore, great efforts should be done to have early market chance and good quality.

The soil and climate requirements of sweet corn are similar to those of fodder corn. Optimum temperature from emergence till blooming is 21–27°C. In the course of blooming, temperatures over 30°C, especially when combined with low humidity, are harmful for the plants. Such conditions cause a lowering of pollen vitality, which leads to a situation where not all the flowers in a cob are pollinated and then the cob is not completely filled with kernels (Rubatzky and Yamaguchi, 1997). Generally, harvest as well as planting schedules is frequently planned using the accumulated heat unit procedure, where the base and upper temperature thresholds for sweet corn are 10°C and 30°C, respectively. However, the best temperature for harvesting sweet corn is 10–16°C. Then the monosaccharides in the kernels transform into starch very slowly (Hewett, 2006). With delayed sowing one should expect a drop in the yield and the quality of the crop. In the case of sweet corn cultivation for direct consumption an important factor is the obtaining of possibly early crop of cobs, which usually guarantees a higher selling price. Sweet corn that matures before the general corn crop typically sells in USA for 50 cents to $1 more per dozen at farmers markets and on-farm and roadside stands. An advantage for early sweet corn is that there is less market competition, making it easier to entice new buyers to purchase the product and possibly become long-term customers (Barnhill, 2006).

As early as in the beginning of the 20th century some researchers (Harris, 1965; Dinkel, 1966) highlighted the importance of the sowing date. Ripening can occur earlier when sowing earlier and using high quality seeds as compared to normal or late sowing

To improve the thermal conditions during seed germination and the initial phase of plant growth for the purpose of early fresh market shipments several techniques were employed such as plantation covering with light polypropylene unwoven cloth, polyethylene foil, or with bedding or mulch that decomposes under the effect of sunlight or microbial activity. This results in soil temperature increase by 2–6°C as compared to noncovered soil, thanks to which the time of corncob harvest may be accelerated by 7– 10 days (Aguyoh *et al.,* 1999**)** Plastic mulches are used at planting as a simple, cost effective and effective soil warming and season extending technique that ultimately improves stand establishment and hastens maturity. Plants growing under the plastic mulch are more uniform since they are protected against cold temperature and damage caused by insects, birds and rodents. Different plastic mulch techniques have been used to enhance emergence, growth and maturity of many vegetable crops including tomato and cucumber (Wolfe *et al.*, 1989) and beet (*Beta vulgaris* L.) (Gimenez *et al.*, 2002). Barnhill (2006) found that corn covered with 0.5-ounce floating row cover matured 5 days earlier than uncovered corn. Direct seeded sweet corn under vlies cover showed earlier ripening and gave better yields in the experiments of (Kassel, 1990). The plots under vlies cover reached harvest maturity 12 days earlier as compared to the plots with no cover. In case of direct seeding, as propagation method, another earliness increasing solution is the temporary covering with plastic or vlies, used in different combinations.

This method reaches about 7–10 days earliness **.**Direct seeded plants with floating cover had favorable influence on ear weight, and ear length as compared with direct seeded plants without cover (Oroszi and Slezak, 2010 and 2011), number of seeds and length of seeds (Oroszi, 2013) as compared with uncovered direct seeds.

Transplanting from the greenhouse to the field when the soil temperature is adequate for proper growth remains a questionable practice for sweet corn production because it imposes physiological stress on the plant and often stunts development. It is also time consuming and increases production costs (Miller, 1972; Wyatt and Mullins, 1989; Waters *et al.,* 1990). When making the decision to cultivate sweet corn from seedlings one should keep in mind that corn is not one of those plant species that easily regenerate damaged root systems. Therefore, the seedlings should be grown in pots with soil mixture with peat, and planted with sufficient care. This method of cultivation – due to the high costs involved – is recommended for small plantations and in years with cold and delayed spring [Wyatt and Mullins, 1989]. Marketable yield from the transplants was inconsistent by location and year. Compared to direct-seeding, transplanting increased earliness but not total yields (Hochmut *et al.,* 1990) Four-week old transplants did not withstand field stress and performed poorly regardless of type of container. Ear quality as indicated by row number, ear diameter, ear length, and tip fill was lowest with transplants (Aguyoh *et al.,* 1999). Three-week-old sweet corn transplants matured 12 days earlier than seeded corn. Results showed no advantage in planting out transplants early. Transplanted corn is consistently shorter than seeded corn, although the ear size does not seem to be affected. Transplants do suffer more from cold weather and drought stress than seeded plants (Barnhill, 2006). In another study it was found that the transplant growing period reduced the growing period by 16 days, compared to the technology used in the existing practice of production. Earliness had a negative influence on ear size (Oroszi and Slezak, 2008).

The choice of a variety with a shorter vegetation period reduces the risk involved in cob ripening and permits the obtaining of cobs of higher quality. Also early cob harvest time gives the possibility of taking advantage of better weather conditions and of getting a better price for the produce (Szymanek, *et al.*, 2006).

The objective of this work was to examine the influence of plastic low tunnels and transplanting on plant growth, yield and quality-related traits of two sweet corn hybrids under early summer planting time of the Egyptian conditions

Materials and Methods

The field experiment was carried out at the Agricultural Experimental Farm, Faculty of Agriculture, Suez Canal University Ismailia Governorate, during the early summer season of 2013 and 2014, to investigate the effect of some planting methods on vegetative growth, yield and ear quality of two sweet corn hybrids.

Physical and chemical properties of the experimental soil were analyzed according to **FAO (1980)** and the results are tabulated in Table 1.

Table 1. Physical and chemical analyses of the experimental soil.

Sand %	Clay %	Silt %	Texture	pH	EC dS/m	Cations meq/l				Anions meq/l			
						Ca^{++}	Mg^{++}	K^{+}	Na^{+}	Co_3^{--}	HCO_3^{-}	Cl^{-}	$SO_4^{=}$
95.7	1.3	3.0	Sandy	8.11	2.03	7.60	1.30	0.49	2.56	1.14	1.60	2.57	6.92

Experimental treatments and design:

The two Sweet yellow F_1 hybrids, Challenger (Simnes, USA) and Dynasty (Syngenta, Holland) were used. In each hybrid 3 planting treatments, namely, direct seeds under low tunnels, transplants in open field (no tunnels) and direct seeds in open field (control) were used. The area of the experimental plot was 17.5 m^2 and consisted of 5 rows, each row was 5 m length and 0.7 m width. The plant distance was 25 cm apart on one side of the row. Seeds were sown in the three planting methods on 2nd and 4th February in 2013 and 2014, respectively. For the purpose of seedling raising, the seeds were sown in speedling trays having 12x8 holes 4 weeks before the transplanting date of two years of the experiment, i.e. on 2nd and 4th March in 2013 and 2014. For seedling growing medium and for cover material a commercial seedling medium consisting of peat moss and vermiculite (1v:1v) + micro nutrients, Maxim at 75 g/m^3) was used. After the seeds had been sown, the trays were placed in a plastic greenhouse. In the course of seedling rising, with the daily irrigation no fertilization or plant protection interventions were carried out.

The plastic cover of the low tunnel was removed on March 26th in 2013 and on March 25th in 2014. The experiment was laid out in split plot design. Sweet corn hybrids were assigned in the main plots, while planting method treatments were distributed in the subplots.

The NPK was applied at a level of 100 kg/fed N, 22.5 kg/fed P_2O_5 and 72 kg/fed K_2O in the form of ammonium nitrate (33.5%), superphosphate (15%) and potassium sulfate (48%), respectively. Furrow irrigation system was used. Half of the N rate and the total of the P and K rates were applied as starter fertilization (about one week before planting), while the rest of the N dose was applied on two occasions, at the 6-7 leaf stage and at tasseling, in the form of top dressing. The other recommended cultural practices of the production were followed. Harvest was done at premature stage (milky stage) on June 2nd in both seasons, and then the following data were recorded.

Data recoded

A. Vegetative growth measurements:

Fifteen plants were randomly chosen at harvest from each plot, to record the vegetative growth parameters as follows:

1. Number of leave/plant.
2. Plant height: From stalk base to tassel top.
3. Stem diameter at the fourth node.
4. Plant fresh weight.
5. Plant dry weight: Plants were dried at 70 C^o until a constant weight.

B. Morphological characters of ears:

Fifteen ears from each plot were randomly taken to record the following data:

1. Ear length: From ear base to top.
2. Ear diameter: central ear diameter.
3. Number of row/ear.
4. Number of kernels/row.
5. Husked and unhusked ear weight.

C. Total yield:

It was recorded for the plants in each plot to estimate ear yield per plot then per feddan

D. Chemical measurements of kernels

Total sugars, reducing sugars, sucrose and starch were determined coloimetrically at 520 mu wave length using the phenol sulfuric method described by Dubois *et al.* (1956). Dry matter percentage was also determined according to the methods described in A.O.A.C. (1995).

Results and Discussion

A. Vegetative growth characters:

Most of vegetative growth characters were significantly affected by the tested hybrids and production methods (Table 1 and 2). 'Dynsty' cultivar showed significantly higher values of plant fresh and dry weight than 'Chalenger'. Meanwhile, no significant differences were detected in the plant height, number of leaves and stem diameter between the two sweet corn cultivars in the two tested seasons.

The comparison among the three planting methods, i.e. direct seeds in open field, transplanting in open field and direct seeds under low tunnels on vegetative growth revealed that, independently from cultivars, growing sweet corn from direct seeds under low tunnels developed plants with greatest values of plant height, plant fresh weight and plant dry weight. Such differences were significant as compared with producing sweet corn via transplants. It was reported that sweet corn has very slow root re-development, but can be transplanted successfully if root disturbance is kept to a minimum (Schrader, 2000). Relative to stem diameter, an important characteristic of plant resistance to wind damage, according to my observations, the direct seeded uncovered treatments had the most favorable stems.

Table 2. Effect of cultivars and planting methods on plant vegetative growth characters of sweet corn.

Treatments		2013					2014				
Hybrids	Planting methods*	Plant height (cm)	No of leaves plant	Stem diameter (cm)	Plant fresh weight (gm)	Plant dry Weight (gm)	Plant height (cm)	No of leaves plant	Stem diameter (cm)	Plant fresh weight (gm)	Plant dry Weight (gm)
Challenger		143.32	9.63	3.2	335.64	49.57	155.15	9.94	2.31	364.63	54.21
Dynasty		150.94	10.17	2.02	447.72	64.93	163.48	10.33	2.15	483.46	70.65
LSD		NS	NS	NS	50.41	10.09	NS	NS	NS	63.21	9.37
	Direct seeds	149.08	9.84	2.13	431.67	62.89	159.03	10.3	2.22	455.09	66.2
	Tunnel direct	162.16	10.51	2.46	436.70	65.67	171.23	11.13	2.49	465.49	69.95
	Transplant	130.16	9.35	1.90	306.67	43.20	147.61	8.99	1.99	351.56	51.15
	LSD	16.34	NS	0.42	64.21	11.45	11.03	NS	0.46	72.89	8.32
Challenger	Direct seeds	146.8	9.67	2.66	390.67	57.71	153.93	9.87	2.57	411.54	60.10
	Tunnel direct	155.92	10.22	2.25	393.25	59.77	168.40	11.03	2.36	427.62	64.37
	Transplant	127.25	9.00	1.99	223.00	31.22	143.13	8.93	2.00	254.73	38.17
Dynasty	Direct seeds	151.36	10.00	2.25	472.67	68.07	164.13	10.73	2.41	498.64	72.3
	Tunnel direct	168.4	10.80	2.00	480.15	71.56	174.05	11.23	2.07	503.35	75.53
	Transplant	133.07	9.70	1.8	390.33	55.17	152.25	9.04	1.98	448.38	64.12
LSD (5%)		29.25	NS	0.58	84.62	16.82	20.79	NS	0.56	93.81	14.63

*Direct seeds=Direct sowing in open field; Tunnel direct seeds=Direct sowing in open field under low plastic tunnels; Transplant=Transplanting in open field

Compared to the covered direct seeded treatment the difference measured in stem diameter was not significant, but in the case of the transplanted treatment the level of the abovementioned difference was also statistically demonstrably, significantly higher. Generally, sweet corn production under low tunnels was relatively more effective than producing corn plants in open field, but with no significant differences between the two methods. Orosz (2009) came to the same conclusion.

The interaction between the hybrid cultivars and production methods on plant height, stem diameter, plant fresh weight and plant dry weight was significant (Table 3). Dynasty hybrid produced under low tunnels gave the highest values of plant height; plant fresh weight and plant dry weight, whereas 'Challenger' grown by transplants produced the shortest plants that had the lowest fresh and dry weights.

B. **Morphological characters of ears:**

No significant differences were observed between the two tested hybrids in all ears morphological characters, i.e. husked and unhusked ear weight, length and diameter of ears, number of row/ear and number of kernels/row (Table 3). On the other hand, the direct seeded planting method had more favorable influence on unhusked ear weight as well as husked weight, length and diameter than seedling rising. The highest means in the two experimental years were measured for the samples of the covered treatment direct seeded at which according to the statistical calculations was significantly favorable at $p<0.05$ confidence level. Conversely, the transplanting treatment produced significantly the lowest weights of unhusked and husked ear with lowest diameter and length as compared to the other treatments. Number of grains per row was not statically influenced by planting method (Table 3).

From customer viewpoint number and average weight of seeds in the ear is an important parameter. The direct seeding under low tunnels produced higher ear quality shown in its weight, diameter and length and in the number of grains per row as compared with the other two planting methods. In the evaluation of the results, it is advisable to pay attention to the fact that these two treatments (direct seeded in open field and transplanting in open field) are highly exposed to the inclemency of weather. The favorable effect of cover on husked ear characters was attributed to increasing soil and air temperatures. According to Kwabiah (2004), maximum temperatures were increased by up to 7° C for soil and up to 10° C for air due to plastic mulch.

Sweet corn is a warm season crop requiring an optimum between 21°C and 27°C for seed germination and seed germination is very slow or fails at soil temperatures below l0° C. Seed should not be planted earlier than 10 days to 2 weeks after the average date of the last killing frost. If planted too early, poor stands, retarded growth, or frost-killed seedlings may result. However, it may be worthwhile to risk the chance of frost in order to get an early crop (Rubatzky and Yamaguchi, 1997).

Barnhill (2006) indicated that sweet corn transplants do suffer more from cold weather and drought stress than seeded plants. On the other hand, cucurbits, legumes, and sweet corn have very slow root re-development, but can be transplanted successfully if root disturbance is kept to a minimum. The previous studies indicated that ear quality as indicated by row number, ear diameter, ear length, and tip fill was lowest with transplants (Aguyoh *et al.,* 1999) and earliness, resulted from using transplanting for wet corn production, had a negative influence on ear size (Oroszi and Slezak, 2008).

Data presented in Table 3 showed that the interaction between cultivars and planting methods had a significant effect on husked and unhusked ear weight in both seasons as well as on ear length and diameter in the first season. In this respect producing 'Challenger' via sowing direct seeds under low tunnels gave the highest values of husked and unhusked ear weight in both seasons as well as on ear length and diameter.

C. **Total ears yield:**

Data presented in Table 4 revealed significant effect for cultivars on yield of unhusked ears and non significant effect on yield of husked ears, while such yields were significantly influenced by planting methods and the interaction between cultivars and planting methods. The effect of these results are confirmed by El-Saidi (2001) using these two cultivars under El-Ayat conditions who recorded non significant differences between ears yield of 'Challenger' and 'Dynasty'. Waters *et al.* (1990) in USA and Bakht *et al.* (2011) in Pakestan came to another conclusion but with other sweet corn cultivars.

The application of low tunnels cover to direct seeded sweet corn plants had clearly positive effect on yield of both husked and nonhusked ears as compared with noncovered direct seeded plants. On the contrary, transplanting had significantly adverse effect on ears yield as compared with direct seeds. Similar results were reported by Orosz (2009) who found that the theoretically planned yield of 16 t/ha in sweet corn under Budapest conditions was reached or surpassed in the case of the covered treatment sown at the earlier date (6 April) and the uncovered control sown at the later date (22 April). On the other hand, transplanted plants showed the lowest ears yield in both planting dates. Similarly, Hochmut *et al.* (1990) reported that compared to direct-seeding, transplanting increased earliness but not total yields.

Table 3. Effect of cultivars and planting methods on ear characters of sweet corn.

Treatments		2013						2014					
Hybrids	Planting methods *	Unhusked ear weight (g)	Husked ear weight (g)	Ear diameter (cm)	Ear length (cm)	Row Number /ear	Number of grains/row	Unhusked ear weight (g)	Husked ear weight (g)	Ear diameter (cm)	Ear length (cm)	Row Number /ear	Number of grains/row
Challenger		335.6	223.7	5.02	19.11	16.05	26.52	331.6	227.2	5.13	19.26	16.03	27.59
Dynasty		329.74	219.49	4.78	18.79	15.37	31.27	328.46	226.3	4.87	19.01	15.48	31.84
LSD		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Direct seeds	343.09	232.95	4.87	18.26	15.73	29.22	346.24	236.89	4.99	19.07	15.77	29.86
	Tunnel direct seeds	354.33	234.25	5.14	20.19	15.89	29.5	364.45	244.69	5.2	20.35	15.93	30.91
	Transplant	299.95	197.58	4.7	18.41	15.52	27.98	279.41	198.72	4.82	17.99	15.58	28.39
	LSD	32.51	26.42	0.40	0.88	NS	NS	39.65	27.16	0.30	0.34	NS	NS
Challenger	Direct seeds	341.32	231.76	5.01	18.86	16.03	26.83	345.33	234.61	5.10	19.00	16.01	27.84
	Tunnel direct seeds	365.34	242.49	5.24	20.61	16.18	27.78	370.65	251.33	5.30	20.70	16.08	29.61
	Transplant	298.83	196.84	4.81	17.85	15.93	24.95	278.81	195.73	5.00	18.07	16.00	25.33
Dynasty	Direct seeds	344.83	234.14	4.93	18.65	15.42	31.60	347.14	239.16	4.87	19.13	15.53	31.87
	Tunnel direct seeds	343.32	226.01	5.03	19.76	15.60	31.22	358.25	238.05	5.10	20.00	15.77	32.20
	Transplant	301.07	198.32	4.59	17.96	15.10	31.00	280.00	201.70	4.63	17.90	15.15	31.45
LSD (5%)		39.11	27.03	0.57	0.33	NS	NS	43.26	36.87	NS	NS	NS	NS

*Direct seeds=Direct sowing in open field; Tunnel direct seeds=Direct sowing in open field under low plastic tunnels; Transplant=Transplanting in open field

Table 4. Effect of cultivars and planting methods on total yield of sweet corn.

Treatments		2013		2014	
Hybrids	Planting methods*	Unhusked total yield (ton/fed)	Husked total yield (ton/fed)	Unhusked total yield (ton/fed)	Husked total yield (ton/fed)
Challenger		5.20	4.29	5.32	4.44
Dynasty		4.87	4.43	5.10	4.62
LSD		0.26	NS	0.16	NS
	Direct seeds	5.54	4.70	5.88	5.02
	Tunnel direct seeds	6.09	5.30	6.44	5.62
	Transplant	3.49	3.09	3.32	2.96
	LSD	0.46	0.42	0.66	0.62
Challenger	Direct seeds	5.78	4.62	5.90	4.79
	Tunnel direct seeds	6.33	5.26	6.62	5.58
	Transplant	3.50	2.98	3.44	2.96
Dynasty	Direct seeds	5.30	4.77	5.86	5.25
	Tunnel direct seeds	5.85	5.33	6.25	5.65
	Transplant	3.47	3.19	3.20	2.95
LSD (5%)		0.56	0.47	0.71	0.69

*Direct seeds=Direct sowing in open field; Tunnel direct seeds=Direct sowing in open field under low plastic tunnels; Transplant=Transplanting in open field

Table 5. Effect of cultivars and planting methods on ear chemical analysis of sweet corn.

Treatments		2013						2014					
Hybrids	Planting methods*	DM %	TSS %	Red. sugars %	Non Red. sugars %	Total sugars %	Starch %	DM %	TSS %	Red. sugars %	Non Red. sugars %	Total sugars %	Starch %
Challenger		22.23	11.95	0.52	11.10	11.62	10.00	22.60	12.08	0.53	11.04	11.57	9.94
Dynasty		23.10	12.28	0.58	14.32	14.90	6.85	22.79	12.53	0.51	13.57	14.08	7.52
LSD		NS	NS	NS	2.81	2.69	2.35	NS	NS	NS	2.18	2.24	2.68
	Direct seeds	22.9	12.10	0.59	12.14	12.73	8.76	22.76	12.60	0.49	11.82	12.31	9.13
	Tunnel direct seeds	22.45	12.31	0.49	12.57	13.06	7.98	22.83	11.92	0.52	12.61	13.13	8.64
	Transplant	22.58	11.94	0.57	13.43	14.00	8.53	23.01	12.40	0.55	12.48	13.03	8.42
	LSD	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Challenger	Direct seeds	22.18	12.05	0.54	10.36	10.90	10.14	22.65	12.43	0.52	10.21	10.73	10.32
	Tunnel direct seeds	22.27	12.21	0.47	10.91	11.38	9.85	22.30	11.86	0.49	11.03	11.52	9.86
	Transplant	22.24	11.59	0.55	12.03	12.58	10.01	22.85	11.95	0.58	11.87	12.45	9.64
Dynasty	Direct seeds	23.62	12.15	0.64	13.92	14.56	7.38	22.87	12.77	0.46	13.43	13.89	7.94
	Tunnel direct seeds	22.63	12.41	0.51	14.23	14.74	6.11	23.36	11.98	0.55	14.19	14.74	7.42
	Transplant	23.05	12.29	0.59	14.82	15.41	7.05	23.17	12.85	0.52	13.09	13.61	7.21
LSD (5%)		NS	NS	NS	2.13	3.04	2.38	NS	NS	NS	2.09	2.27	1.63

*Direct seeds=Direct sowing in open field; Tunnel direct seeds=Direct sowing in open field under low plastic tunnels; Transplant=Transplanting in open field

The interaction between cultivars and planting methods revealed that the highest ears yield was obtained by sowing seeds of 'Challenger' cultivar under low tunnels, whereas the lowest one was recorded for 'Dynasty' plants grown by transplants (Table 4).

D. **Chemical compositions of grains :**

Based on the experiences from the two experimental years percentages of non reducing and total sugars were higher in 'Dynasty' than in 'Challenger' hybrid, while 'Challenger' had significantly higher starch than 'Dynasty' (Table 5). Such results were true in each planting method (Table 5). The planting treatments did not have any significant effect on ear chemical parameters, i.e the percentage of dry matter, TSS, reducing sugars, nonreducing sugars, total sugars and starch (Table 5). The results of Orosz (2009) revealed that the use of transplants had favorable effect on the level of simple sugars (glucose, fructose etc.), while the application of cover had more favorable influence at the earlier date of propagation. On the other hand, when the year was unfavorable, the grains of the control treatment (direct seeds in late planting date with no cover) had the highest reducing sugar content.

The interaction effect between cultivars and planting methods was significant on the percentages of non-reducing and reducing sugars as well as on percentage of starch in kerns. In this concern, producing 'Denasty' hybrid by transplanting or direct seeds under low tunnels gave the highest percentages of non-reducing and total sugars, while the highest percentage of starch was recorded for 'Challenger' hybrid produced by direct seeds.

References

Aguyoh, J., Taber, G.H. and Lawson, V. (1999): Maturity of fresh market sweet corn with direct seeded plants, transplants, clear plastic mulch and rowcover combinations. HortTech., 9(3): 420-425,

A.O.A.C, (1995). Method of analysis. Association of Official Agriculture Chemists. 16th ed, Washington D.C. USA.

Bakht, J., Shafi, M., Rehman, H., Uddin, R. and Anwar, S. (2011). Effect of planting methods on growth, phenology and yield of maize varieties. Pak. J. Bot., 43(3): 1629-1633.

Barnhill, J. (2006). Early sweet corn production. www.westernsare.org/content/download/1490/10868/2005 -

Dinkel, D. H. (1966). Polyethylene mulches for sweet corn in northern latitudes. Proc. Amer. Soc. Hort. Sci., 89:497-504.

Dubois, M., Gilles, K.A., Hamilton, J.K., Rebers, P.A. and Smith, F. (1956). Colorimetric method for determination of sugars and related substances. Anal Chim., 28:350-356.

El-Saidi, M.M.A. (2001). Physiological studies on sweet corn. M.Sc. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University.

FAO (Food and Agriculture Organization). (1980). Soil and Plant Analysis. Soils Bulletin, 38/2,250

Gimenez, C., Otto, R.F. and Castilla, N. (2002). Productivity of leaf and root vegetable crops under direct cover. Scientia Hort., 94: 1–11

Harris, R. E. (1965). Polyethylene covers and mulches for corn and bean production in northern regions. Proc. Amer. Soc. Hort. Sci., 87:288-294.

Hewett, E.W. (2006). An overview of preharvest factors influencing postharvest quality of horticultural products. International Journal of Postharvest Technology and Innovation, 1, (1), 4–15.

Hochmut, G.J. and Cantliffe, D.J. and Meline, C. (1990. Mulching and planting methods affect performance of sweet corn in Florida. Proc. Fla. State Hort. Soc., 103:91-93.

Kassel, L. V. G. (1990), Direktaussaat von Zuckermais unter Vlies. Gemüse, 26: (7), pp. 350.

Kwabiah,A.B. (2004). Growth and yield of sweet corn (Zea mays L.) cultivars in response to planting date and plastic mulch in a short-season environment. Scientia Hortic., 102: 147–166

Makhlouf, J., Zee, J., Tremblay, N., Bélanger, A., Michaud, M.H. and Gosselin, A. (1995). Some nutritional characteristics of beans, sweet corn and peas (raw, canned and frozen) produced in the province of Quebec. Food Res. Intern. 28: (3), 253–259

Miller, R.A. (1972). Forcing sweet corn. HortScience, 7: 424–428.

Rubatzky, V.E and Yamaguchi, M. (1997). World Vegetables: Principles, Production and Nutrient Values. The Avi Publishing Co., Westport, CT, p. 235-252,

Orosz, F. (2009). Effect of growing technology elements of earliness of sweet corn. Ph.D. Department of Vegetable and Mushroom Growing, Corvinus University of Budapest.

Orosz, F. (2013). Sweet corn growing period and morphological properties in wet year. IV International Symposium Agrosym 2013"232-237.

Orosz, F and Slezák, K. (2008): Effect of cultivation methods on sweet corn earliness. Proceedings. 43rd Croatian and 3rd International Symposium on Agriculture. University of Zagreb, Faculty of Agriculture, Opatija. Croatia, 496-499.

Orosz, F. and Slezák, K (2010). Ear properties of direct seeded sweet corn. Acta Universitatis

Sapientiae Agriculture and Environment, 2: 23–30.

Orosz, F.and Slezák, K. (2011): Yield of early sweet corn. Proceedings. 46th Croatian and 6th International Symposium on Agriculture. University of Zagreb, Faculty of Agriculture, Opatija. Croatia, 563-566

Schrader,W.L. (2000). Using transplants in vegetable production. Publication 8013. 12 pp, University of California, Division of Agriculture and Natural Resources, http://anrcatalog.ucdavis.edu

Szymanek, M., Dobrzanski jr., B., Niedzioka, I and Rybczynski, R. (2006). Sweet corn, harvest and technology, physical properties and quality. Published by Bohdan Dobrzanski Institute of Agro physics of Polish Academy of Science, Lublin, 234 pp.

US- Department of Agriculture (2010). National agricultural statistics service, Agricultural statistics.http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1564

Warman, P.R. and Havard, K.A. (1998). Yield, vitamin and mineral contents of organically and conventionally grown potatoes and sweet corn. Agric. Ecosyst. Environ., 68: 207–216

Waters Jr., L., Burrows, B.L., Bennett, M.A. and Schoenecker, J. (1990). Seed moisture and transplant management techniques influence sweet corn stand establishment, growth, development, and yield. J. Am. Soc. Hort. Sci., 115: 888–892.

Wolfe, D.W., Albright, L.D. and Wyland, J. (1989). Modeling row cover effects on microclimate and yield: growth response of tomato and cucumber. J. Am. Soc. Hort. Sci., 114: 562–568.

Wyatt, J.E. and Mullins, J.A. (1989). Production of sweet corn from transplants. HortScience, 24: 1039–1942.

تأثير طرق الزراعة المختلفة على نمو ومحصول وجودة هجينين من هجن الذرة الحلوة

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تم تنفيذ تجربتى الحقل فى محطة التجارب الزراعية بكلية الزراعة جامعة قناة السويس فى محافظة الأسماعيلية فى فصل الصيف فى عامى2013 و 2014 ، حيث تم دراسة تأثير بعض طرق الزراعة على النمو الخضرى والمحصول وصفات جودة الكوز فى هجينين للذرة الحلوة ، و تم استخدام القطاعات المنشقة فى تصميم التجربة حيث تم توزيع الهجينين شالنجر و ديناستى فى القطع الرئيسية و معاملات طرق الزراعة (بالبذرة مباشرة تحت الأنفاق ، والشتلات فى الحقل المكشوف ، وبالبذرة مباشرة فى الحقل المكشوف) فى القطع الفرعية وذلك فى 4 مكرات . اظهرت النتائج أن النباتات المزروعة بالبذرة تحت الأنفاق قد اعطت اعلى قيم بالنسبة لأرتفاع النبات ووزن النبات الطازج و الوزن الجاف للنبات ، بينما تفوقت النباتات المزروعة بالبذرة مباشرة فى الحقل المكشوف بالنسبة لوزن الكوز المقشر و غير المقشر . لم تكن لطرق الزراعة المختلفة تأثير على الصفات الكيمائية للكوز مثل نسبة المادة الجافة والسكريات المختزلة وغير المختزلة وكذلك السكريات الكلية و النشا ، وبالمقابل اعطت معاملة الشتلات اقل وزن للكيزان سواء كانت مقشرة او غير مقشرة كذلك بالنسبة لطول وقطر الوز مقارنة بالمعاملات الأخرى . تفوق الصنف ديناستى على الصنف شالنجر فى الوزن الجاف والطازج للنبات ، و كذلك النسبة المئوية للسكريات الكلية والغير مختزلة، بينما تفوق الصنف شالنجر على الصنف ديناستى فى النشا . من ناحية أخرى لم يكن هناك اى تأثير معنوى لصنفى الذرة الحلوة على الصفات المورفولوجية للنبات (كارتفاع النبات و عدد الأوراق وقطر الساق) ، و كل الصفات المورفولوجية للكوز (وزن الكوز مقشر وغير مقشر ، وطول وقطرالكوز) ، ومحصول الكوز المقشر لكليهما ، و كذلك الصفات الكيمائية للحبوب (نسبة المادة الجافة ، ونسبة المواد الصلبة الذائبة ، والسكريات المختزلة)