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AN ATTEMPT TO IMPROVE SWEET CORN SEED GERMINATION UNDER LOW TEMPERATURE CONDITIONS BY USING SEED PRIMING

El-Saifi, S. K.[1]; H. M. I. Ahmed[2]*; M. M. Morsi[1] ; Sawsan M. Hasan[1] and Rowaa S. El-Shatoury[1]

[1] Horticulture Dept., Fac. of Agric. (Ismaila), Suez Canal Univ., Egypt.

[2] Vegetable Crops Seed Production and Technology Dept., Horticulture Res. Inst., Agric. Res. Center, Giza, Egypt.

*** Corresponding Author E-Mail: hamdino@yahoo.com**

ABSTRACT

This study was conducted during the years of 2007, 2008 and 2009 in the Laboratory of the Department of Horticulture, Faculty of Agriculture, Suez Canal University, Ismalia, Egypt. This experiment was carried out to study the effect of seed priming under low temperature on seed germination, seedling growth and chemical constituents of sweet corn.

Seed priming of sweet corn seeds in mannitol or PEG at 25 ^oC recorded maximum values of germination percentage, fresh and dry weight/seedling and gave the tallest seedling, whereas seed priming in KNO_3 at 25 ^oC gave the earliest germination and more uniformity of germination in both seasons. Seed priming in KNO3 at 10 ^oC increased contents of total carbohydrate, total phenol and amylase enzyme in seedling, whereas seed priming in mannitol at 10 ^oC increased peroxidase enzyme.

Keywords: Sweet corn, seed priming, low temperature, germination percentage, seedling growth.

INTRODUCTION

Sweet corn (*Zea mays* var. rugosa) is a herbaceous annual. Seed priming as a presowing treatment in which seeds are soaked in a osmotic solution that allows them to imbibe water and go through the first stages of germination, but dose not permit radical protrusion through the seed coat. The seeds then can be dried to their original moisture contents and stored or planted via conventional technique (Heydecker, 1973).

In cold, wet soils the intervals between planting and emergence of the seedling is critical to stand establishment and eventual yield. If this interval is long, seeds and seedlings may be killed by soil pathogens. Moreover, long- term pre- emergence exposure to low temperature reduces seedling growth after emergence (Meidema, 1982). Cold, wet soils are even more determined to germination and emergence if poor-quality seed is planted (Erwin, 1934).

Sweet corn is planted early because early planting increased yield/ plant (Chon and Obendrof, 1972), price per unit of product and efficiency in use of processing plants.

To meet the demands of early markets, the sweet corn sees are often planted in many areas in soils cooler than 10 ^oC (Sabata *et al*.1987).

Corn inbreeds are planted when mean soil temperature is 10 ºC and lower are often injured by cold water imbibitional stress (Chon and Obendrof, 1978).

For improving germination rate and seedling growth of sweet corn seeds would be primed under low temperature conditions by using seed priming, i.e., mannitol, KNO_3, PEG, $MgSO_4$, $CaCl_2$ and KH_2PO_4.

Bodsworth and Bewley (1981) found that polyethylene glycol (PEG) 6000 promoted seed germination of two field corn cultivars when germinated at 10 ºC. Osmoconditianing with PEG at 35 ºC increased seedling length of maize, whereas decreased of dry weight (Seong *et al*., 1986). Soaking seeds of sweet corn in PEG (6000) or in moist vermiculate (hydration) for 24 h at 25 ºC improved emergence percentage , reduced mean emergence time and uniformity of emergence compared with non primed sweet corn (Sung and Change, 1993).

The objective of this work was to improve emergence and seedling growth of sweet corn under cool conditions by using seed priming.

MATERIALS AND METHODES

To assess the priming effects on germination parameters of sweet corn (*Zea mays* var. rugosa) cultivar Merecure, the study has been conducted during the years of 2007, 2008 and 2009 in the Laboratory condition of the Department of Horticulture, Faculty of Agriculture, Suez Canal University, Ismalia, Egypt. This experiment was designed to study the effect of seed priming on germination behavior and seedling growth of sweet corn under different low temperature degree in the laboratory.

Seed priming was done as follows: seeds (100 g each) were primed in eight aerated flasks in different priming agents. Treatments were applied at -1.0 Mega Pascal (MPa) of (1) PEG 6000, (2) mannitol, (3) KNO_3, (4) $MgSO_4$, (5) $CaCl_2$, or (6) KH_2PO_4 plus (7) without priming to serve as control. Thiram was added at 0.2% to each flask to prevent fungal growth during the treatment (Zbitnew, 1984). Where, -1MPa of PEG 6000 was calculated according to (Michel and Kaufmann 1973)

The flasks were kept in a laboratory at 25˚C ± 2 for 144 hours. At the end of priming treatment, the seeds were spread on dry blotters on the laboratory bench. A portable dryer was positioned to maintain a stream of drying air above the seeds, at 25 to 30˚C temperature. The blower was left on for 6 hours, and the seeds were left overnight on the bench to dry down to a moisture content of 6-7%. Seeds were stored in paper envelopes at laboratory conditions of 25 ± 3˚C until the seed were used in the experiments.

Osmotic potential of the priming solutions was calculated according to Van't Hof expression:

$$\psi = - m \cdot i \cdot R \cdot T$$

Where ψ is the Osmotic potential, m is the molality, i is the number of dissociating ions, R is the gas constant and T is the temperature in Kelvin (273 + °C) (Lang 1967).

Laboratory experiments:

Laboratory germination tests were done on four replications of 100 seeds each. Seeds were sown on rolled filter paper and placed in plastic boxes which kept during the germination period in separate germination cabinet at different four temperature degrees .i.e., (1) 10 ^oC, (2) 15 ^oC, (3) 20 ^oC and (4) 25 ^oC,

This experiment included 36 treatments which were the combination between 9 seed priming treatments and four temperature degrees. These treatments were arranged in a randomized complete block design with four replicates for each treatment.

Data recorded:

I- Seed germination measurements:

1-**Germination percentage** (**GP %**): It was measured according to the ISTA rules (ISTA, 1999).

2- **Mean time to germination in days (MGT**): It was calculated according to the formula MGT=Σ nd/N where n is the number of germinated seed on each day, the number of days from the beginning of the test, and N the total number of germinated seeds (Edwards and Sundstrom, 1987).

3- Coefficient of velocity: It was calculated according to the formula Coefficient of velocity = 1/ MGT X 100 where MGT is mean time to germination in days (Edwards and Sundstrom, 1987).

4- Germination performance index (GPI): It was calculated according to the formula

GPI= GP/MGT

where GP is germination percentage and MGT is mean time to germination in days (Pill and Fieldhouse, 1982)

5-**Time to reach 50% germination (T_{50}), days required to 50% germination**: It was calculated according to the following formula of Coolbear *et al.* (1984) modified by Farooq *et al.* (2005):

$$T_{50} = t_i + [(N/2-n_i)(t_j-t_i)]/(n_j - n_i)$$

Where:

N : The final number of germination.

n_i, n_j : Cumulative number of seeds germinated by adjacent counts at times when $n_i < N/2 < n_j$.

6-Uniformity of germination, the time in days occurring between 25% and 75% of germination (T75-T25).

II- Seedling growth measurements:

1- Seedling length (cm).

2- Seedling fresh weight (mg): It was measured on ten seedlings randomly taken from each replicate, weighed, and the average fresh weight per seedling was calculated.

3- Seedling dry weight (mg): The same seedlings taken for the determination of fresh weight were used to measure dry weight. They were oven-dried at 70ºC until constant weight was reached. The average weight per dried seedling was calculated.

III- Seedling enzymatic activity:

1- Amylase activity: It was measured according to the method described by **Bernfeld (1955).**

2- Peroxidase activity: It was determined according to the method described by **Vetter (I958).**

IV- Chemical constituents of seedling:

1- Total carbohydrates: It was estimated according to the method described by Dubois *et al.,(*1956).

2- Total phenols: It was estimated according to the method described by Kâhkônen *et al.* (1999) and Singleton and Rossi (I965).

Statistical analysis: The treatments mean were compared using the Duncan Multiple Range test as published by Duncan (1965).

RESULTS AND DISCUSSION

1- Germination measurements

Concerning the effect of low temperature on germination measurements, data in Tables 1 and 2 show that germination percentage (GP%), germination performance index and coefficient of velocity significantly were increased with increasing germination temperature with no significant differences with 20 ºC with respect to GP%, whereas mean germination time (MGT), uniformity germination and T50 % significantly were decreased with increasing germination temperature up to 25 ºC in both seasons. This means that, germination sweet corn seeds at 25 ºC recorded maximum values of GP %, GPI and coefficient of velocity, whereas recorded minimum values of MGT, uniformity of germination and T50 %.

Table (1). Effect of low temperature and seed priming treatment on germination percentage (GP %), mean germination time (MGT) (days) and germination performance index (GPI) of sweet corn seeds under laboratory conditions during 2008 and 2009 seasons.

Characters / Treatments	GP %		MGT (days)		GPI	
	First season	Second season	First season	Second season	First season	Second season
Effect of low temperature						
10 °C	70.29	68.43	7.30	7.76	12.47	12.37
15 °C	78.71	76.67	4.60	3.53	19.57	19.61
20 °C	85.86	84.14	3.31	3.20	27.74	28.14
25 °C	86.29	84.29	2.83	2.73	31.85	32.34
L.S.D 0.05	0.62	0.63	0.06	0.06	0.05	0.05
Effect of priming agents						
Control	68.00	66.25	9.38	7.85	11.26	11.19
PEG	84.50	82.50	3.35	3.24	27.17	27.41
Mannitol	86.25	84.50	3.39	3.29	27.99	28.40
KNO_3	83.25	81.75	3.14	3.04	29.27	29.73
$MgSO_4$	78.50	76.50	4.46	4.11	19.05	19.16
$CaCl_2$	80.50	78.42	3.48	3.61	25.63	25.94
KH_2PO_4	81.00	78.75	4.37	5.03	19.99	19.97
L.S.D 0.05	0.82	0.84	0.08	0.07	0.07	0.06

Table (2). Effect of low temperature and seed priming treatment on coefficient of velocity, uniformity of germination and T50 % of sweet corn seeds in the laboratory during 2008 and 2009 seasons.

Characters / Treatments	Coefficient of velocity		Uniformity of germination		T50 %	
	First season	Second season	First season	Second season	First season	Second season
Effect of low temperature						
10 °C	17.16	17.48	6.21	6.12	7.48	7.38
15 °C	24.32	24.99	4.24	4.18	5.36	5.26
20 °C	32.10	33.32	3.39	3.29	3.88	3.78
25 °C	36.58	38.07	2.86	2.75	3.61	3.51
L.S.D 0.05	0.06	0.06	0.10	0.04	0.05	0.05
Effect of priming agents						
Control	15.19	15.49	7.48	7.46	8.73	8.62
PEG	31.50	32.63	3.25	3.15	3.92	3.82
Mannitol	31.96	33.16	3.06	2.97	3.67	3.57
KNO_3	34.45	35.83	3.25	3.14	3.95	3.84
$MgSO_4$	24.01	24.67	4.13	4.03	5.44	5.33
$CaCl_2$	31.29	32.44	3.50	3.40	4.75	4.66
KH_2PO_4	24.39	25.05	4.56	4.46	5.13	5.03
L.S.D 0.05	0.07	0.07	0.13	0.06	0.07	0.06

As for the effect of seed priming treatments, the obtained results in Tables 1 and 2 show that seed primed in mannitol gave the maximum values of GP% and minimum values of uniformity of germination and T50 , whereas seed priming in KNO3 gave the maximum values of coefficient of velocity and GPI and minimum values of MGT in both seasons.

Faster emergence rate after osmopriming may be explained by an increased rate of cell division in the root tips (Bose and Mishara, 1992). The beneficial aspects of priming are primarily due to preenlargement of the embryo (Khan, 1992) and improvement of germination rate (Gray and Steckie, 1997). The earlier and better germination is associated with increased metabolic activities in the osmoprimed seeds (Lui *et al*., 1986).

The effect of interaction on germination measurements are presented in Tables 3 and 4. the obtained results show that maximum GP% was observed in seeds osmoprimed with mannitol or PEG when germinated at 25 ^oC, minimum MGT, uniformity of germination and T50 were observed in seeds osmoprimed with KNO_3 under low temperature (25 ^oC) in both seasons. Maximum GPT was noted in seeds osmoprimed in KNO_3 when germinated at 25 ^oC. These results agree with those reported by Bodswarth and Bewley (1981) and Sung and Change (1993) on sweet corn.

2- Seedling growth

Concerning the effect of low temperature on seedling growth, presented data in Table 5 indicate that seedling length, fresh and dry weight were significantly increased with increasing low temperature up to 25 ^oC .This means that germination of seeds at 25 ^oC was the best treatment for enhancing seedling length, fresh and dry weight of seedling in both seasons.

Table (3). Effect of the interaction between low temperature and seed priming treatment on germination percentage (GP %), mean germination time (MGT) (days) and germination performance index (GPI) of sweet corn seeds under laboratory conditions during 2008 and 2009 seasons.

Low temperature	Priming	GP%		MGT) (days)		GPI	
		First season	Second season	First season	Second season	First season	Second season
10 °C	Control	51.00	50.00	19.23	19.13	2.65	2.61
	PEG	74.00	72.00	4.62	4.51	16.02	15.96
	Mannitol	79.00	77.00	4.98	4.87	15.86	15.81
	KNO_3	73.00	71.00	4.58	4.47	15.94	15.88
	$MgSO_4$	70.00	68.00	6.34	6.23	11.04	10.91
	$CaCl_2$	72.00	70.00	5.21	5.13	13.82	13.65
	KH_2PO_4	73.00	71.00	6.11	6.05	11.95	11.74
15 °C	Control	61.00	59.00	9.18	9.09	6.64	6.49
	PEG	83.00	81.00	3.44	3.35	24.13	24.18
	Mannitol	84.00	82.00	3.52	3.43	23.86	23.91
	KNO_3	82.00	80.00	3.33	3.21	24.62	24.92
	$MgSO_4$	79.00	77.00	4.62	4.51	17.10	17.07
	$CaCl_2$	80.00	78.00	3.52	3.42	22.73	22.81
	KH_2PO_4	82.00	80.00	4.58	4.47	17.90	17.89
20 °C	Control	80.00	78.00	5.12	5.03	15.63	15.51
	PEG	90.00	88.00	2.74	2.63	32.85	33.46
	Mannitol	90.00	89.00	2.68	2.57	33.58	34.24
	KNO_3	89.00	87.00	2.42	2.31	36.78	37.66
	$MgSO_4$	83.00	81.00	3.78	3.67	21.96	22.07
	$CaCl_2$	84.00	82.00	2.76	2.65	30.43	30.94
	KH_2PO_4	85.00	82.00	3.66	3.55	23.22	23.10
25 °C	Control	80.00	78.00	3.98	3.87	20.10	20.16
	PEG	91.00	89.00	2.58	2.47	35.66	36.03
	Mannitol	92.00	90.00	2.38	2.27	38.66	39.65
	KNO_3	89.00	87.00	2.24	2.15	39.73	40.47
	$MgSO_4$	82.00	80.00	3.11	3.01	26.37	26.58
	$CaCl_2$	86.00	84.00	2.42	2.31	35.54	36.36
	KH_2PO_4	84.00	82.00	3.12	3.02	26.92	27.15
L.S.D0.05		1.71	1.76	0.16	0.15	0.14	0.13

These results may be due to that low temperature at 25 °C recorded maximum germination rate and speed, earlier germination and more uniformity of germination (Table 1 and 2)

With respect to the effect of seed priming , the obtained results in Table 5 illustrate that the tallest seedling and the maximum values of fresh and dry weight of seedlings were observed in seeds osmoprimed with mannitol followed by PEG in both seasons.

These results may be due to that mannitol recorded earlier germination and more uniformity of germination (Table 1 and 2)

The effects of interaction on seedling growth are presented in Table 6. The obtained results show that seed priming in mannitol or in PEG when germinated at 25 °C gave the tallest seedling and recorded the maximum fresh and dry weight of seedling in both seasons.

These results coincided with those reported by Seong et *al*. (1986) on sweet corn.

Table (4). Effect of the interaction between low temperature and seed priming treatment on coefficient of velocity, uniformity of germination and T50 % of sweet corn seeds under laboratory conditions during 2008 and 2009 seasons.

Low temperature	Priming	Coefficient of velocity		Uniformity of germination		T50 %	
		First season	Second season	First season	Second season	First season	Second season
10 °C	Control	5.20	5.23	13.50	13.42	16.22	16.11
	PEG	21.65	22.17	5.00	4.91	5.22	5.12
	Mannitol	20.08	20.53	4.50	4.41	5.18	5.07
	KNO_3	21.83	22.37	4.75	4.64	5.66	5.55
	$MgSO_4$	15.77	16.05	5.00	4.91	7.00	6.91
	$CaCl_2$	19.19	19.49	4.50	4.42	6.35	6.24
	KH_2PO_4	16.37	16.53	6.25	6.14	6.75	6.66
15 °C	Control	10.89	11.00	7.75	7.65	9.25	9.14
	PEG	29.07	29.85	3.00	2.91	4.00	3.92
	Mannitol	28.41	29.15	3.00	2.92	3.75	3.65
	KNO_3	30.00	31.15	3.25	3.14	4.25	4.13
	$MgSO_4$	21.65	22.17	4.25	4.14	5.75	5.64
	$CaCl_2$	28.41	29.24	3.75	3.64	5.00	4.91
	KH_2PO_4	21.83	22.37	5.00	4.91	5.50	5.41
20 °C	Control	19.53	19.88	5.25	5.14	4.75	4.67
	PEG	36.50	38.02	2.75	2.64	3.33	3.23
	Mannitol	37.31	38.91	2.50	2.41	3.00	2.91
	KNO_3	41.32	43.29	2.75	2.64	3.12	3.02
	$MgSO_4$	26.46	27.25	3.75	3.64	4.66	4.56
	$CaCl_2$	36.23	37.73	3.00	2.91	4.00	3.91
	KH_2PO_4	27.32	28.17	3.75	3.64	4.25	4.15
25 °C	Control	25.13	25.84	3.75	3.64	4.66	4.55
	PEG	38.76	40.49	2.25	2.14	3.11	3.01
	Mannitol	42.02	44.05	2.25	2.14	2.75	2.64
	KNO_3	44.64	46.51	2.25	2.15	2.78	2.67
	$MgSO_4$	32.15	33.22	3.50	3.42	4.33	4.22
	$CaCl_2$	41.32	43.29	2.75	2.63	3.66	3.57
	KH_2PO_4	32.05	33.11	3.25	3.13	4.00	3.91
L.S.D0.05		0.15	0.15	0.27	0.21	0.13	0.13

Table (5). Effect of low temperature and seed priming treatment on seedling length (cm), fresh weight (gm) and dry weight (gm) of sweet corn seeds under laboratory conditions during 2008 and 2009 seasons.

Characters / Treatments	Seedling length (cm)		Fresh weight (gm)		Dry weight (gm)	
	First season	Second season	First season	Second season	First season	Second season
Effect of low temperature						
10 °C	18.95	18.86	0.849	0.845	0.064	0.061
15 °C	19.96	19.87	0.948	0.937	0.071	0.069
20 °C	21.46	21.38	0.996	0.992	0.074	0.072
25 °C	21.90	21.82	1.047	1.041	0.078	0.076
L.S.D 0.05	0.08	0.05	0.005	0.004	0.001	0.001
Effect of priming agents						
Control	17.10	17.02	0.756	0.750	0.057	0.054
PEG	21.50	21.41	1.079	1.068	0.080	0.078
Mannitol	21.50	21.42	1.106	1.097	0.083	0.081
KNO_3	21.28	21.19	0.975	0.971	0.074	0.072
$MgSO_4$	20.98	20.89	0.903	0.899	0.067	0.065
$CaCl_2$	20.70	20.62	1.008	1.002	0.075	0.073
KH_2PO_4	20.90	20.82	0.893	0.888	0.067	0.065
L.S.D 0.05	0.11	0.07	0.006	0.006	0.002	0.002

Table (6). Effect of the interaction between low temperature and seed priming treatment on seedling length, fresh weight and dry weight of sweet corn seeds under laboratory conditions during 2008 and 2009 seasons.

Low temperature	Priming	Seedling length (cm)		Fresh weight (gm)		Dry weight (gm)	
		First season	Second season	First season	Second season	First season	Second season
10 °C	Control	12.20	12.10	0.650	0.645	0.049	0.043
	PEG	20.50	20.41	0.950	0.947	0.071	0.069
	Mannitol	20.30	20.22	0.940	0.938	0.070	0.068
	KNO_3	20.00	19.91	0.900	0.897	0.067	0.065
	$MgSO_4$	20.00	19.92	0.830	0.827	0.062	0.060
	$CaCl_2$	19.70	19.62	0.870	0.865	0.065	0.062
	KH_2PO_4	19.90	19.81	0.800	0.795	0.061	0.059
15 °C	Control	15.40	15.31	0.725	0.719	0.054	0.052
	PEG	21.20	21.11	1.080	1.050	0.080	0.078
	Mannitol	21.30	21.21	1.090	1.070	0.081	0.079
	KNO_3	21.00	21.91	0.950	0.943	0.077	0.075
	$MgSO_4$	20.50	20.41	0.900	0.098	0.067	0.065
	$CaCl_2$	20.10	20.00	1.000	0.991	0.075	0.073
	KH_2PO_4	20.20	20.11	0.890	0.887	0.066	0.063
20 °C	Control	19.80	19.71	0.800	0.795	0.060	0.058
	PEG	22.00	21.91	1.092	1.089	0.081	0.079
	Mannitol	22.00	21.92	1.190	1.181	0.089	0.087
	KNO_3	21.90	21.82	1.000	0.997	0.075	0.073
	$MgSO_4$	21.50	21.42	0.913	0.908	0.068	0.066
	$CaCl_2$	21.30	21.23	1.050	1.047	0.078	0.076
	KH_2PO_4	21.70	21.63	0.930	0.926	0.069	0.067
25 °C	Control	21.00	20.97	0.850	0.843	0.063	0.061
	PEG	22.30	22.22	1.195	1.187	0.089	0.087
	Mannitol	22.40	22.31	1.205	1.199	0.090	0.088
	KNO_3	22.20	22.11	1.050	1.045	0.078	0.076
	$MgSO_4$	21.90	21.81	0.968	0.963	0.072	0.070
	$CaCl_2$	21.70	21.62	1.110	1.105	0.083	0.081
	KH_2PO_4	21.80	21.71	0.950	0.945	0.071	0.069
L.S.D0.05		0.23	0.14	0.01	0.01	0.01	0.004

3- Chemical constituents of seedling

As for the effect of low temperature , the obtained results in Table 7 illustrate that, germination of seeds at 10 ºC gave the highest values of total carbohydrate and total phenol in seedling of sweet corn, whereas at 25 ºC gave the highest values of amylase and peroxidase enzymes in seeds in both seasons.

The effect of seed priming on chemical constituents of germinated seeds are presented in Table (7). The obtained results in Table 7 indicate that seed priming in KNO_3 increased contents of total carbohydrate , total phenol and amylase enzyme in seedling, whereas mannitol increased content of peroxides enzyme.

As for the effect of interaction, presented data in Table 8 indicate that seed priming in KNO_3 when germinated at 10 ºC increased contents of total carbohydrate, total phenol and amylase enzyme in seedling, whereas seed priming in mannitol when germinated at 10ºC increased content peroxidase enzyme in both seasons.

Table (7). Effect of low temperature and seed priming treatment on total carbohydrate, total phenol, amylase and peroxidase of sweet corn seeds under laboratory conditions during 2008 and 2009 seasons.

Characters / Treatments	Total carbohydrate (% FW)		Total phenol (mg (GA)/gm DW)		Amylase (µg glucose/min/gm FW)		Peroxidase (∆OD 405×10^3 min/gm FW)	
	First season	Second season	First season	Second season	First season	Second season	First season	Second season
Effect of low temperature								
10 °C	5.86	5.85	6.07	6.07	216.86	214.86	76.00	74.00
15 °C	5.66	5.66	5.90	5.90	238.43	236.43	91.29	89.30
20 °C	5.57	5.56	5.67	2.67	261.29	259.29	101.86	99.87
25 °C	5.52	5.52	5.65	5.65	264.86	262.86	103.43	101.44
L.S.D 0.05	0.001	0.004	0.001	0.004	0.45	0.44	0.44	0.44
Effect of priming agents								
Control	4.77	4.77	6.90	6.90	199.50	197.50	78.50	76.50
PEG	5.72	5.71	5.55	5.54	261.75	259.75	102.25	100.25
Mannitol	5.81	5.81	5.68	5.68	258.75	256.75	103.50	101.50
KNO_3	5.80	5.79	5.75	5.75	272.00	270.00	100.50	98.50
$MgSO_4$	5.76	5.75	5.63	5.63	236.00	234.00	92.00	90.00
$CaCl_2$	5.96	5.96	5.62	5.62	260.25	258.25	89.50	87.50
KH_2PO_4	5.76	5.76	5.64	5.64	229.25	227.25	85.75	83.75
L.S.D 0.05	0.002	0.006	0.002	0.006	0.6	0.58	0.58	0.58

Table (8). Effect of the interaction between low temperature and seed priming treatment on total carbohydrate, total phenol, amylase and peroxidase of sweet corn seedlings under laboratory conditions during 2008 and 2009 seasons.

Low temperature	Priming agents	Total carbohydrate (% FW)		Total phenol (mg (GA)/gm DW)		Amylase (µg lucose/min/gm FW)		Peroxidase (∆OD 405×10^3 min/gm FW)	
		First season	Second season	First season	Second season	First season	Second season	First season	Second season
10 °C	Control	5.03	5.03	7.60	7.60	172	170	52	50
	PEG	5.94	5.94	5.72	5.72	232	230	87	85
	Mannitol	5.98	5.98	5.87	5.87	235	233	89	87
	KNO_3	6.01	6.01	5.91	5.91	242	240	87	85
	$MgSO_4$	5.98	5.98	5.74	5.74	205	203	75	73
	$CaCl_2$	6.12	6.12	5.83	5.83	234	232	72	70
	KH_2PO_4	5.93	5.93	5.80	5.80	198	196	70	68
15 °C	Control	4.83	4.83	7.01	7.01	198	196	75	73
	PEG	5.71	5.71	5.61	5.61	253	251	102	100
	Mannitol	5.83	5.83	5.75	5.75	250	248	101	99
	KNO_3	5.81	5.81	5.83	5.83	266	264	100	98
	$MgSO_4$	5.74	5.74	5.71	5.71	230	228	89	87
	$CaCl_2$	5.97	5.97	5.70	5.70	252	250	88	86
	KH_2PO_4	5.75	5.75	5.72	5.72	220	218	84	82
20 °C	Control	4.59	4.59	6.53	6.53	216	214	95	93
	PEG	5.59	5.59	5.43	5.43	282	280	111	109
	Mannitol	5.73	5.73	5.56	5.56	276	274	112	110
	KNO_3	5.68	5.68	5.64	5.64	292	290	109	107
	$MgSO_4$	5.61	5.61	5.53	5.53	257	255	102	100
	$CaCl_2$	5.84	5.84	5.48	5.48	279	277	100	98
	KH_2PO_4	5.63	5.63	5.51	5.51	252	250	95	93
25 °C	Control	4.63	4.63	6.45	6.45	212	210	92	90
	PEG	5.62	5.62	5.42	5.42	280	278	109	107
	Mannitol	5.71	5.71	5.53	5.53	274	272	112	110
	KNO_3	5.68	5.68	5.63	5.63	288	286	106	104
	$MgSO_4$	5.69	5.69	5.54	5.54	252	250	102	100
	$CaCl_2$	5.91	5.91	5.47	5.47	276	274	98	96
	KH_2PO_4	5.72	5.72	5.52	5.52	247	245	94	92
L.S.D0.05		0.00004	0.0004	0.31	0.29	0.00003	0.00003	0.29	0.29

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محاولـة لتحسـين إنبـات بـذور الـذرة السـكرية تحـت ظـروف الحـرارة المنخفضـة باستخدام مهيئات الإنبات

سـمير كامـل الصـيفى[١]، حمـدينو محمـد إبـراهيم أحمـد [٢] ، محمـد محمـد مرسـى[١] ، سوسن مجمد حسن[١] ، رواء صلاح الشطورى[١]

[١] قسم البساتين- كلية الزراعة بالاسماعلية- جامعة قناة السويس-مصر

[٢] قسم بحوث تقاوى الخضر - معهد بحوث البساتين- مركز البحوث الزراعية- الجيزة-مصر

٢٠٠٩ أجريت مجموعة من التجارب خلال عامي ٢٠٠٧ – ٢٠٠٨ و ٢٠٠٨- ٢٠٠٩ بمعمل قسم البساتين – كلية الزراعة بالاسماعيلية- جامعة قناة السويس – مصر . لدراسة تأثير مهيئات الانبات على سلوك الانبات والتركيب الكيماوى والنشاط الانزيمى فى الذرة السكرية تحت ظروف اجهاد الحرارة المنخفضة واوضحت النتائج أن تهيئة بذور الذرة السكرية فى المانيتول أو البولى ايثلين جليكول سجل أعلى نسبة انبات وكذلك أعطى أعلى القيم للوزن الطازج والجاف وطول البادرات وخاصة عند درجة ٢٥ م° بينما التهيئة فى نترات البوتاسيوم ثم الانبات فى درجة حرارة ٢٥ م° اسرع من الانبات وذاد من نسبة تماثل الانبات فى كلا الموسمين – اذداد معنويا محتوى البادرات من الكربوهيدرات والفينولات الكلية كما اذداد نشاط انزيم الاميليز عند تهيئة بذور الذرة السكرية فى نترت البوتاسيوم ثم انباتها عند درجة حرارة ١٠ م° بينما اذداد نشاط انزيم البيروكسيديز عند التهيئة فى المانيتول ثم الانبات على درجة حرارة ١٠ م°

قام بتحكيم البحث

أ.د / سمير طه محمود العفيفى	**كلية الزراعه – جامعة المنصوره**
أ.د / عبدالله برديسى احمد	**كلية الزراعة – جامعة الزقازيق**