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Research Article
Seed Treatments to Improve Germination and Emergence of Muskmelon at Suboptimal Temperatures

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Abstract

Background and Objective: A major factor is limiting in the cultivation of melons during the off-season is the poor performance of the most cultivars under suboptimal low temperatures. The current study was conducted to investigate effects of incorporating Prohexadione-Calcium (Pro-Ca) into the priming solutions on low temperature germination and emergence performances of melon (*Cucumis melo* cv. 'Kırkağaç 637') seeds. **Materials and Methods:** Priming was accomplished by imbibing muskmelon seeds for 4 days at 25°C in darkness in solutions of KNO_3 or KH_2PO_4, each at -1.50 MPa, containing 0, 25, 50, 75 or 100 mg L^{-1} Pro-Ca. After priming treatment, the seeds were washed with distilled water and dried at 20°C temperature on filter paper for 24 h, then subjected to germination and emergence tests at 15 and 20°C. **Results:** Priming muskmelon seeds in the presence or absence of plant growth regulators in general improved final germination percentage (FGP), mean germination time (MGT), germination index (GI), final emergence percentage (FEP) and mean emergence time (MET), emergence index (EI) compared to non-primed seeds at both temperatures. **Conclusion:** The results of the study indicated that inclusion of Pro-Ca into the priming solutions can be used as an effective method to improve low temperature germination performance muskmelon seeds.

Key words: Melon, priming, plant growth regulator, low temperature

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Melon (*Cucumis melo* L.) is one of the important warm season vegetable crops. In 2016, Melons were cultivated on over 1,246,000 ha year^{-1} with an annual crop production of approximately 31,167,000 t in the world. China, Turkey, Iran, India, Egypt, Kazakhstan, United States, Morocco, Spain and Guatemala are the main producer countries in the world[1]. Despite being a warm season crop, it has become an important off-season crop in many parts of the world[2]. A major factor is limiting in the cultivation of melons during the off-season is the poor performance of the most cultivars under suboptimal low temperetures[3]. Optimum temperature range for melon seed germination is between[4] 25 and 35°C. Melons will not tolerate chilling or soil temperatures below 13°C. The rate of germination and emergence of melons is markedly reduced at temperatures in the range of 15-20°C. Poor germination and emergence are common phenomenon at sub-optimal temperatures which is a great concern of growers that grow melon and watermelon seedlings early spring in Turkey[5]. Increasing and hastening the germination and emergence of melon seed, especially at sub-optimal temperatures would be of significant value in the production of greenhouse-grown plants and in the production of field-grown plants in early spring.

One of the techniques to increase germination and seedling emergence is seed priming. Priming technique consists of incubation of seeds in an osmoticum whose osmotic potential is sufficient to permit initial germination events but not enough for radicle protrusion[6,7]. The priming process enables the seeds to germinate and emerge faster at suboptimal temperatures[8]. Since some important pre-germinative steps such as DNA and RNA synthesis are already accomplished in the seed, the primed seeds are physiologically closer to germination than non-primed seeds after planting[9]. It has been reported that seed priming improves germination and emergence of melon seeds under suboptimal temperatures[10-12]. Incorporation of plant growth regulators during pre-soaking and priming treatments have improved seed germination and emergence performances in many crops including melons[4,13]. But there is still a need to learn more about new plant growth regulators and where they fit into our seed management. Therefore, this study was conducted to investigate effects of incorporating Prohexadione-Calcium (Pro-Ca) into the priming solutions on low temperature germination and emergence performances of melon seeds.

MATERIALS AND METHODS

This study was conducted over a 5 month period between January-June, 2016 at Vegetable Physiology Laboratory, Department of Horticulture, Faculty of Agriculture and University of Bingol, Turkey. Muskmelon (*Cucumis melo* L.) seeds of cv. 'Kirkagac 637' (Bursa Seed Company, Bursa, Turkey) were used in the experiments. The initial seed moisture was 6% (dry weight basis). Moisture contents were determined according to the standardized laboratory test for moisture content by the oven method[14]. The standard germination test of melon was conducted on the seeds and their initial germination percentage was determined as 90%. The seeds were stored in a sealed container at 10°C and 45% relative humidity until used. The mixture of peat moss and perlite [4:1 (v/v)] was used as the growing media in the experiments. Peat moss is the most commonly used soilless medium. It is widely available and relatively inexpensive[15]. Perlite improves drainage and aeration by creating tiny air tunnels that allow water and air to flow freely to the roots. Perlite can hold 3-4 times its weight in water, yet will not become soggy[15,16].

Priming treatments: Based on results of the preliminary experiments, KNO_3 and KH_2PO_4 were chosen as priming agents. The priming agents were supplemented with 0, 25, 50, 75 or 100 mg L^{-1} Prohexadione Calcium (Regalis, BASF 125 10W containing 10% Prohexadione-Ca as the active ingredient). For all the treatments, the seeds were surface disinfested in 1% (active ingredient) sodium hypochlorite (NaOCl) for 10 min to eliminate seed-borne micro-organisms. After disinfestation, they were washed under running tap water and surface moisture was removed by placing them between sterile paper towels for 30 min at room temperature. Priming was accomplished by imbibing melon seeds for 4 days at 25°C in darkness in solutions of KNO_3 or KH_2PO_4, each at -1.50 MPa containing 0, 25, 50, 75 or 100 mg L^{-1} Pro-Ca. The melon seeds were placed in covered plastic germination boxes (10×10×4 cm) on double layers of filter paper (Whatman # 1) saturated with 8 mL priming solution. Following priming, the seeds from each box were washed in a sieve and rinsed under running tap water to remove priming chemicals and left to surface dry on drying papers placed in petri dishes under room conditions (20°C and 45% relative humidity) for 24 h. Untreated dry seeds were taken as control.

Germination and emergence tests: Germination and emergence tests were carried out in a growth chamber (Model ICE 256, Memmert, Germany) at 15 and 20°C. Melon seeds were placed on two layers of filter paper moistened with 3 mL of distilled water in sterile standard 90×15.7 mm (diameter×height) Petri plates. Treatments were arranged in a completely randomized design with four replications of 25 seeds. The filter papers were moistened with distilled water as needed. Germination throughout the paper is defined as visible radicle protrusion through the seed coat and pericarp. The numbers of the germinated seeds were recorded daily until no further germination occurred. From the total number of seeds germinated, nal germination percentage (FGP) and its angular transformation (arcsine√FGP), mean time to germination (MTG) and germination index (GI) were calculated[17]. For emergence test, seeds were primed as described above and 25 seeds from each treatment were planted into 1.5 cm depth in 7×5 cm (diameter×height) round plastic cups filled with growth medium consisting of peat and perlite in the ratio of 4:1. The cups were watered and placed in the same growth chamber used in germination test. The cups were moistened with distilled water as needed. Seedling emergence was recorded daily for 18 days. The seedlings were counted as emerged when the hypocotyls appeared above the surface of the growing media. Final emergence percentage (FEP) and its angular transformation (arcsine√FEP), mean time to emergence (MTE) and emergence index (EI) were calculated.

Experimental design and statistical analysis: The experiments were arranged according to completely randomized design with three replicates, each replicate having 25 seeds. The experiments were repeated twice. Data were analyzed by one-way ANOVA using Duncan's Multiple Range Test (DMRT) at a significance level of $p \leq 0.05$.

RESULTS

Final germination percentage (FGP): Results showed that priming treatments significantly improved FGP of melon seeds as compared to control treatment (non-primed seeds). The seeds primed with KNO_3 supplemented with Pro-Ca had higher FGP than either the seeds primed with KH_2PO_4 supplemented with Pro-Ca or non-primed seeds in both temperatures (Table 1). In the germination test conducted at 15°C, the highest FGP (28%) was obtained from the seeds primed in KNO_3 with 25 mg L^{-1} Pro-Ca followed by the treatments of KNO_3 with 0 and 50 mg L^{-1} Pro-Ca (24%) in the same statistical group. KH_2PO_4 supplemented with 75 and 100 mg L^{-1} Pro-Ca and non-primed seeds resulted in the lowest FGP (8.00, 5.33 and 9.33%, respectively) at 15°C. There was no statistical difference among the treatments of KNO_3 supplemented with Pro-Ca levels in terms of FGP at 20°C. KH_2PO_4 supplemented with 75 and 100 mg L^{-1} Pro-Ca or non-primed seeds resulted in the lowest FGP (57.33, 58.67 and 53.33%, respectively) at 20°C, which is similar to the results obtained at 15°C (Table 1).

Mean germination time (MGT): Priming treatments had a significant effect ($p \leq 0.001$) on MGT of melon seeds and improved MGT of the seeds as compared to control treatment (non-primed seeds) at both temperatures. The priming treatments decreased the MGT in melon seeds at 15°C compared to the non-primed seeds (Table 2). In other words, they shortened the mean germination time compared to the non-primed seeds. At temperature of 20°C, melon seeds primed with KNO_3 supplemented with Pro-Ca (except for 100 mg L^{-1} dose) had lower MGT than either the seeds primed with KH_2PO_4 supplemented with Pro-Ca or non-primed seeds (Table 2). The KNO_3 supplemented with 0. 25 and 50 mg L^{-1} Pro-Ca gave the lowest MGT values (7.72, 8.26 and 7.69 days, respectively). KH_2PO_4 supplemented with 100 mg L^{-1} Pro-Ca gave the highest MTG value (11.42 days), which means that the melon seeds primed with it took longer time to germinate compared to treatments.

Germination index (GINDEX): The seeds primed with KNO_3 supplemented with Pro-Ca had higher GINDEX than either the seeds primed with KH_2PO_4 supplemented with Pro-Ca or non-primed seeds at both temperatures tested (Table 3). The results showed that at temperature 15°C, KNO_3 supplemented with 25 mg L^{-1} Pro-Ca gave the highest GINDEX value with 0.65 (Table 3). This treatment was followed by the KNO_3 supplemented with 50 and 100 mg L^{-1} Pro-Ca treatments (0.54 and 0.53, respectively). At temperature of 20°C, KNO_3 supplemented with 50 mg L^{-1} Pro-Ca gave the highest GINDEX value with 3.17. This treatment was followed by the KNO_3 alone treatment (2.83). KH_2PO_4 supplemented with 100 mg L^{-1} Pro-Ca gave the lowest GINDEX value which is 1.47 at 20°C (Table 3).

Final emergence percentage (FEP): In general, while priming treatments of KNO_3 supplemented with Pro-Ca significantly improved FEP of melon seeds. KH_2PO_4 supplemented with Pro-Ca treatments (except for 25 and 50 mg L^{-1}) decreased FEP as compared to control treatment (Table 4). The seeds

Table 1: Effects of priming treatments on final germination (%) [FGP and angular transformation (in brackets)] of melon seeds at low temperatures

Priming treatments		FGP (%)	
Priming agents	Pro-Ca (mg L^{-1})	15°C	20°C
KNO_3	0	24.00 (29.33)^{ab}	77.33 (61.67)^{ab}
	25	28.00 (31.67)^{a}	77.33 (61.67)^{ab}
	50	24.00 (29.33)^{ab}	82.67 (65.67)^{a}
	75	18.67 (25.66)^{bc}	74.67 (60.00)^{ab}
	100	25.33 (30.00)^{ab}	82.67 (65.00)^{a}
KH_2PO_4	0	10.67 (18.67)^{de}	58.67 (50.00)^{c}
	25	14.67 (22.33)^{cd}	69.33 (56.67)^{b}
	50	14.67 (22.33)^{cd}	69.33 (56.67)^{b}
	75	8.00 (16.00)^{ef}	57.33 (49.33)^{c}
	100	5.33 (13.33)^{f}	58.67 (49.67)^{c}
Non primed seeds		9.33 (17.33)^{ef}	53.33 (46.67)^{c}
$LSD_{0.05}$		4.81	6.18
Significance		***	***

*** Significant at p<0.001, Means followed by the same letter are not significantly different at the 0.05 level, using Duncan's Multiple Range Test (DMRT)

Table 2: Effects of priming on mean germination time (MGT) of melon seeds at low temperatures

Priming treatments		MGT (days)	
Priming agents	Pro-Ca (mg L^{-1})	15°C	20°C
KNO_3	0	13.31^{bc}	7.72^{d}
	25	11.13^{f}	8.26^{d}
	50	11.55^{def}	7.69^{d}
	75	11.39^{ef}	9.28^{c}
	100	12.47^{bcdef}	10.17^{bc}
KH_2PO_4	0	12.61^{bcde}	10.10^{bc}
	25	11.95^{cdef}	9.84^{bc}
	50	12.69^{bcde}	10.38^{b}
	75	13.66^{bc}	10.16^{bc}
	100	12.83^{bcd}	11.42^{a}
Non primed seeds		15.00^{a}	9.52^{bc}
$LSD_{0.05}$		1.43	0.90
Significance		***	***

***Significant at p<0.001, Means followed by the same letter are not significantly different at the 0.05 level using Duncan's multiple range test (DMRT)

Table 3: Effects of priming on germination index (GINDEX) of melon seeds at low temperatures

Priming treatments		GINDEX	
Priming agents	Pro-Ca (mg L^{-1})	15°C	20°C
KNO_3	0	0.47^{bc}	2.83^{ab}
	25	0.65^{a}	2.64^{b}
	50	0.54^{ab}	3.17^{a}
	75	0.43^{bcd}	2.47^{b}
	100	0.53^{ab}	2.43^{b}
KH_2PO_4	0	0.22^{efg}	1.81^{cd}
	25	0.31^{cde}	2.00^{c}
	50	0.29^{def}	1.90^{cd}
	75	0.14^{fg}	1.56^{de}
	100	0.10^{g}	1.47^{e}
Non-primed seeds		0.16^{efg}	1.72^{cde}
$LSD_{0.05}$		0.15	0.41
Significance		***	***

***Significant at p<0.001, Means followed by the same letter are not significantly different at the 0.05 level using Duncan's multiple range test (DMRT)

primed with KNO_3 supplemented with Pro-Ca had higher FEP than either the seeds primed with KH_2PO_4 supplemented with Pro-Ca or non-primed seeds in both temperatures. As for FEP at 20°C, the highest FEP value (74.67%) was obtained from the treatment of KNO_3 supplemented with 50 mg L^{-1} Pro-Ca (Table 4).

Mean emergence time (MET): Results of the current study showed that priming treatments were more effective on MET and significantly improved MET of melon seeds as compared to the non-primed seeds. At 15°C, the control treatment had highest MET (16.71 days) among the treatment and it was significantly different from other treatments (Table 5).

Table 4: Effects of priming treatments on final emergence percentage (FEP and angular transformation (in brackets)) of melon seeds at low temperatures

Priming treatments		FEP (%)	
Priming agents	Pro-Ca (mg L^{-1})	15°C	20°C
KNO_3	0	30.67 (33.33)^{ab}	65.33 (54.33)^{abcd}
	25	34.67 (36.00)^{a}	60.00 (50.67)^{bcd}
	50	29.33 (32.33)^{ab}	74.67 (59.67)^{a}
	75	25.33 (30.00)^{bc}	70.67 (57.33)^{ab}
	100	28.00 (31.67)^{ab}	62.67 (52.33)^{abcd}
KH_2PO_4	0	10.67 (18.67)^{e}	56.00 (48.67)^{cde}
	25	20.00 (26.67)^{cd}	60.00 (50.67)^{bcd}
	50	16.00 (23.67)^{d}	68.00 (56.00)^{abc}
	75	10.67 (18.67)^{e}	56.00 (48.33)^{cde}
	100	9.33 (17.33)^{e}	53.33 (46.67)^{de}
Non primed seeds		16.00 (23.67)^{d}	44.00 (41.67)^{e}
$LSD_{0.05}$		4.53	7.94
Significance		***	**

**Significant at p<0.01, ***Significant at p<0.001, Means followed by the same letter are not significantly different at the 0.05 level, using Duncan's multiple range test (DMRT)

Table 5: Effects of priming on mean emergence time (MET) of melon seeds at low temperatures

Priming treatments		MET (days)	
Priming agents	Pro-Ca (mg L^{-1})	15°C	20°C
KNO_3	0	14.04^{bcd}	9.77^{b}
	25	13.93^{bcd}	10.74^{ab}
	50	14.79^{b}	9.35^{b}
	75	14.25^{bc}	9.52^{b}
	100	13.77^{bcd}	9.57^{b}
KH_2PO_4	0	14.44^{bc}	10.49^{ab}
	25	13.57^{cd}	10.10^{b}
	50	14.03^{bcd}	10.51^{ab}
	75	14.38^{bc}	10.84^{ab}
	100	13.05^{d}	11.79^{a}
Nonprimed seeds		16.71^{a}	11.83^{a}
$LSD_{0.05}$		1.12	1.54
Significance		***	*

*Significant at p<0.05, ***Significant at p<0.001, Means followed by the same letter are not significantly different at the 0.05 level, using Duncan's multiple range test (DMRT)

This means that the melon seeds primed took longer time to germinate compared to treatments. The priming treatments decreased the MET in melon seeds at 15°C compared to the non-primed seeds. In other words, they shortened the mean emergence time compared to the non-primed seeds. At 20°C, the KNO_3 priming treatments (except for 25 mg L^{-1} Pro-Ca) decreased the MET in melon seeds compared to the non-primed seeds (Table 5).

Emergence index (EINDEX): In general, priming treatments of KNO_3 supplemented with Pro-Ca significantly improved EINDEX of melon seeds as compared to control treatment and the treatments of KH_2PO_4 at both temperatures (Table 6).

Relationships between germination and emergence properties of melon seeds at 15°C: The correlation analysis showed that there were numerous significant correlations among variables used in germination and emergence properties of melon seeds at 15°C (Table 7). The data showed strong positive correlation between FGP and GI (r =0.979). Similarly, FEP exhibited strong positive correlation with the EI (r = 0.987). Mean germination time (MGT) had positive correlation coefficients with mean emergence time (MET) of primed seeds (r = 0.431). The results of the current study revealed negative correlations between MGT and GI (r = -0.596). The result showed strong positive correlation between FGP each one FEP (r = 0.918) or EI r = 923). Mean germination time had negative correlation between each one of the GI (r = 0.596) or FEG (r = 461) or EI (r = 0.505). The data showed strong positive correlation between GI each one of FEP (r = 0.907) or EI r = 924).

Relationships between germination and emergence properties of melon seeds at 20°C: The correlation analysis showed that there were numerous significant correlations

Table 6: Effects of priming on emergence index (EINDEX) of melon seeds at low temperatures

Priming treatments		EINDEX	
Priming agents	Pro-Ca (mg L^{-1})	15°C	20°C
KNO_3	0	0.55^{ab}	1.84^{abc}
	25	0.63^{a}	1.96^{ab}
	50	0.50^{ab}	2.14^{a}
	75	0.51^{ab}	1.74^{abc}
	100	0.45^{bc}	1.54^{cd}
KH_2PO_4	0	0.18^{e}	1.48^{cd}
	25	0.38^{cd}	1.6^{bcd}
	50	0.29^{de}	1.79^{abc}
	75	0.19^{e}	1.46^{cde}
	100	0.18^{e}	1.28^{de}
Non primed seeds		0.25^{de}	1.05^{e}
$LSD_{0.05}$		0.124	0.412
Significance		***	***

***Significant at p<0.001, Means followed by the same letter are not significantly different at the 0.05 level, using Duncan's multiple range test (DMRT)

Table 7: Pearson correlation coefficients of the germination and emergence properties of melon seeds at 15°C

Variables	FGP	MGT	GI	FEP	MET	EI
FGP	1.00					
MGT	-0.498**	1.00				
GI	0.979**	-0.596**	1.00			
FEP	0.918**	-0.461**	0.907**	1.00		
MET	-0.103	0.431*	-0.142	-0.055	1.00	
EI	0.923**	-0.505**	0.924**	0.987**	-0.182	1.00

Numbers followed by *Significant at p≤0.05, **Significant at p≤0.01

Table 8: Pearson correlation coefficients of the germination and emergence properties of melon seeds at 20°C

Variables	FGP	MGT	GI	FEP	MET	EI
FGP	1.00					
MGT	-0.512**	1.00				
GI	0.881**	-0.827**	1.00			
FEP	0.715**	-0.330	0.622**	1.00		
MET	-0.559**	0.442*	-0.548**	-0.506**	1.00	
EI	0.740**	-0.419*	0.675**	0.953**	-0.727	1.00

Numbers followed by *Significant at p≤0.05, **Significant at p≤0.01

among variables used in germination and emergence properties of melon seeds at temperature 20°C (Table 8). The data showed strong positive correlation between FGP and GI (r = 0.881). Similarly, FEP exhibited strong positive correlation with the EI (r = 0.740). Mean germination time (MGT) had positive correlation coefficients with mean emergence time (MET) of primed seeds (r = 0.442). The result showed positive correlation between FGP each one FEP (r = 0.715) or EI (r = 740). The FGP has negative correlation with MET (r = 0.559). Mean germination time had negative correlation between each one of the GI (r = 0.596) or FEG (r = 461) or EI (r = 0.505). The data showed strong positive correlation between GI each one FEP (r = 0.907) or EI (r = 924).

DISCUSSION

Results showed that priming treatments significantly improved FGP of melon seeds as compared to control treatment (non-primed seeds). This results confirmed the findings of some previous studies[4,18]. The seeds primed with KNO_3 supplemented with Pro-Ca had higher FGP than either the seeds primed with KH_2PO_4 supplemented with Pro-Ca or non-primed seeds in both temperatures. This result agrees with those of Singh *et al.*[19], who reported faster and higher total germination of sorghum using KNO_3 solution.

When the mean germination times were evaluated, it was found that primed seeds were more effective on mean germination time than control at low temperature. These results are compatible with some previous studies such as sugar beet[20], muskmelon[4,10] and eggplant[21]. Demir *et al.*[22] reported that GA_3 and KNO_3 treatments influenced on eggplant seed germination and rate of germination respect comparing that of the control. On the other hand, in some studies, there are also reports that the priming did not have an effect on the mean germination time. For example, in a study carried out by Basay *et al.*[23], it was stated that PEG and KNO_3

solution in Kandil variety pepper seeds increased germination but not the mean germination time.

Results showed that priming treatments significantly improved germination index of melon seeds as compared to control treatment. This finding is also in agreement with those of Ozbay and Susluoglu[18].

Results showed that priming treatments significantly improved FEP of melon seeds as compared to control treatment (non-primed seeds) at low temperatures. The seeds primed with KNO_3 supplemented with Pro-Ca had higher FEP than either the seeds primed with KH_2PO_4 supplemented with Pro-Ca or non-primed seeds in both temperatures. This finding confirms the findings of Korkmaz[24], who reported that priming treatments significantly improved FEP and emergence rate of pepper seeds at low temperature. In another study, Korkmaz *et al.*[4] reported that priming muskmelon seeds with the solution of KNO_3 supplemented 1 µM MeJA and 1 mM spermine improved low temperature emergence of muskmelon seeds compared to untreated seeds and seeds primed in KNO3 solution alone. The researchers also reported that inclusion of 1 µM MeJA and 3 mM spermine into the priming solution led to the highest emergence percentages with 90 and 85%, respectively, while priming in KNO_3 solution in the absence of plant growth regulators resulted in significantly lower emergence percentage (31%).

When the mean emergence time was evaluated, it was found that primed to seeds was more effective on mean germination time than control at both temperatures. Some of the priming treatments decreased MET compared to the control. This result supported the findings of Korkmaz[24]. However, these results are not in agreement with those obtained on tomato rootstock[25] and tomato[26]. They reported the primed seeds reduced mean time of emergence.

Results showed that priming treatments significantly improved germination index of melon seeds as compared to control treatment. The seeds primed with solution KNO_3 supplemented with Pro-Ca had highest germination index than either the seeds primed with KH_2PO4 supplemented with Pro-Ca or the control seeds at temperature 15°C. This result agrees with those of Farooq *et al.*[26], who reported maximum germination index of tomato was obtained using KNO_3 solution. In a study carried out by Sivritepe and Senturk[27], priming and drying applications with water and salt solutions were compared for the physiological improvement of pepper seeds.

The correlation analysis showed that there were numerous significant correlations among variables used in germination and emergence properties of watermelon seeds at temperature 15 and 20°C. At 15°C, there was a strong positive correlation between FGP and GI (r = 0.969). Similarly, FEP exhibited positive correlation with the EI (r = 0.969). Mean germination time (MGT) had positive correlation coefficients with mean emergence time (MET) of primed seeds (r = 0.429). These results are in agreement with Bradford[28] and Demir *et al.*[29], who reported that there was a positive association between MGT and MET. However, results of the current study revealed strong negative correlations between MGT and GI (r = -0.827). These results are in line with Kausar *et al.*[30], who have reported that highly negative correlation was found between MGT and GI of primed sunflower seeds.

CONCLUSION

The results of present experiment showed that the improvement of the percentage of germination and emergency of melon seeds at the low temperatures, especially 15°C was related with priming treatments. Incorporation of Pro-Ca into the priming agents especially treatments of KNO_3 further increased the percentage of germinating and emerging melon and watermelon seeds at 15 and 20°C.

SIGNIFICANCE STATEMENT

There is still a need to learn more about new plant growth regulators and where they fit into our seed management. This study discovered that the priming combined with new plant growth regulator, Prohexadione-Calcium, can be beneficial for promoting germination and emergence of melon seeds at low temperature. This study will help the researchers and farmers who want to sow muskmelon seeds in early spring in the field when the temperatures are suboptimal for germination.

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