QUALITY OF STORED MELON (*CUCUMIS MELO* L.) SEEDS GROWN UNDER DIFFERENT IRRIGATION REGIMES

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Abstract. Ecological diversity is the richest heritage of the countries that they wish to hand down the next generations. Landraces constitute an important group of biodiversity resources. Especially the effects of stress on seed quality of landraces known to be resistant to abiotic and biotic stress factors is an important issue. Majority of producers preserve their seeds and serious quality losses are encountered in long-term storage of these seeds. In this sense, seeds obtained from Hırsız Kaçıran melon population grown under three different irrigation levels (50%, 100%, 150%) in Çanakkale province by Çiftci (2013) were stored for 5 years. In addition, new seeds (fresh seeds) were supplied from the experiments conducted under similar conditions with that previous study. Then, quality parameters of stored and fresh seeds were evaluated and compared. Seed color, germination rate, mean germination time, controlled deterioration test and electrical conductivity (EC), seed moisture, emergence rate and mean emergence time parameters were determined. According to the data obtained, germination and emergence rates were not affected on the other hand germination and emergence times were affected negatively by irrigation treatments. It was concluded that, Hırsız Kaçıran melon genotype is able to maintain germination rate for both irrigation regimes, whether the seeds could be stored at certain seed moisture condition without significant loss of vigor.
Keywords: *landraces, seed vigor, germination, seed storage, pan coefficient*

Introduction

Turkey is a prominent country in genetic diversity of melon (*Cucumis melo* L.) and thus is one of the centers within the area extending from the Mediterranean basin to Central Asia, then to Far East (Robinson and Decker-Walters, 1997). Several local melon varieties are still being grown by producers in Turkey. Landrace producers mostly continue their cultivation activities by producing their own seeds. Seed quality directly influences vegetable production and production costs. Use of qualified seeds is a pre-condition of successful production and plays a greater role in production of landraces over limited areas. Although landraces are preferred because of their resistance to harsh climate conditions of the region to where they were adapted, recent droughts pose a serious risk on entire agricultural activities. Adverse conditions caused by drought inevitably affect seed production and cause losses in seed yield (Szilagyi, 2003; El Balla et al., 2013) that makes the seed an expensive starting material. Therefore, majority of producers prefer to store seeds. However, during the storage process of seeds, cell membrane breakdown, lipid peroxidation, protein degradation and decrease in enzyme activities are encountered and seed vigor decreased due to the recess in respiration capacity (Walters, 1998; McDonald, 1999; Murthy et al., 2003; Finch-Savage and Bassel, 2016). Cucurbit seeds, like many orthodox seeds, can be stored for a long time by drying up to low moisture levels and slowing down relevant biochemical activities (Vertucci, 1989). Oluoch and Welbaum (1996) indicated that melon seeds maintained viability for 6 years under suitable conditions. Bass (1973)

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conducted 12-year storage study with cantaloupe melons and reported that majority of the cultivars maintained germination rate at end of 12-year storage (10°C/60% humidity) and decrease in values of the cultivars with a loss of vigor was seen at the end of 7th year. On the other hand, Doijode (2006), stated that melon seeds stored at -20ºC maintained viability by 86% at the end of 15-year storage. Similarly, Nerson (2002) reported that watermelon seeds could be stored for 10 years without significant loss in quality traits. Ali et al. (1991) stored the seeds of Marketer, Marketmore, Wisconsin SMR-18, Tablegreen, Spotfree and China cucumber varieties at 3°C and 38% humidity for 26 years and indicated that varieties, except one, had 80% germination ratio in the 10th year, but germination was not encountered in the 13th and later years. Pandey (2016) preserved the seeds in hermetic containers with a solution containing glycerol and $CaCl_2$ to store them at room temperature for a long time and indicated that majority of cucurbit seeds maintained viability for 14 -16 years and some varieties remained viable even in the 24th year.

Various tests can be used to determine the long-term storage limit of cucurbit seeds. Abdalla and Roberts (1969) indicated that seed viability and vigor tests could be used to determine the storage life of seeds. It is also indicated for cucurbit family that controlled deterioration tests performed at 45ºC, 24% humidity and 48 hours could reliably be used to determine seed viability in melons and 45ºC, 24% humidity and 24 hours in cucumbers (Bhering et al., 2004; Torres, 2005). The tests designating seed quality, including controlled deterioration tests, enable the determination of changes in seed quality before and after storage. It was reported that viability of semi-ripe melon seeds increased after 6 months of storage at 10°C and 45% relative humidity and similar findings were also reported for cucumber seeds (Edwards et al., 1986; Nerson and Paris, 1988).

Quality loss is low and the storage life is at an acceptable level in seed production of landraces adapted to harsh conditions grown under non irrigated conditions. So the negative effects of drought on seed production will be alleviated and seed production in arid areas will be sustainable to a certain extent. Hırsız Kaçıran is a landrace which grown under non or limitedly irrigated in Aegean region of Turkey. And producers often adopt the method of obtaining their own seeds for production.

This study was conducted to determine the extent of quality loss with the aid of quality tests in seeds produced under different irrigated conditions and stored for a long time.

Material and Method

Seeds of the study was supplied from melon landrace “Hırsız Kaçıran” grown in Biga district of Çanakkale (Aegean part of Turkey) in 2013. Seeds were planted at 100 x 100 cm spaced plots irrigated in 7-day intervals by applying three different irrigation levels (multiplying Class-A pan evaporation by Kp1= 50%, Kp2= 100%, Kp3= 150% coefficients and cover percentage, which was taken as 30% at the beginning and increased accordingly later on) (Çiftci, 2013).

$$I = Epan \times Kp \times P \qquad \text{(Eq.1)}$$

(Doorenbos and Pruitt, 1992; Kanber et al., 1994; Aslan and Tekıner, 2017)
where;
I: amount of irrigation water to be applied(mm), Epan: Pan evaporation (mm), Kp: Pan coefficient, P: plant cover percentage (%).

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The amount of irrigation water applied and evaporation values in the two seasons is presented in *Table 1* and *Table 2*.

Table 1. *The amount of water given in irrigation treatments and evaporation values (I. seasons) (2013)*

Treatments	Evaporation (mm)	50% irrigation level	100% irrigation level	150% irrigation level
1	65	32.5	65	97.5
2	70	35	70	105
3	75	37.5	75	112.5
4	70	35	70	105
5	40	20	40	60
6	60	30	60	90
7	60	30	60	90
8	50	25	50	75
Total	490	245	490	735

Table 2. *The amount of water given in irrigation treatments and evaporation values (II. seasons) (2019)*

Treatments	Evaporation (mm)	50% irrigation level	100% irrigation level	150% irrigation level
1	30	15	30	45
2	32	16	32	48
3	53	26,5	53	79.5
4	28	14	28	42
5	43	21,5	43	64.5
6	35	17,5	35	52.5
7	41	20,5	41	61.5
Total	262	131	262	393

Melons were marked at full-bloom stage, harvested after 40-45 days, seeds were removed and stored for 5 years (10% (±1) relative humidity and +4 ºC). These seeds constituted the seed material of the present study. Newly produced Hırsız Kaçıran seeds were supplied from the stored seeds and grown in the same experimental design with similar agronomic practices. Harvested fruits were cut into half, seed cavity was removed and washed. Seeds were dried on drying papers (*Figure 1*). The seeds, passed through the same processes and stored were also taken out of the storage and analyzed similarly. Following equation was used for the performance of irrigation practices.

Seed Color (L value, chroma, hueº)

Seed color of parameters (L, a and b) of each treatment were determined by chromameter Minolta CR400. Resultant a and b values were used to calculate chroma and hue^{o} values (McGuire, 1992).

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Figure 1. *Experiment area and melon fruits*

Standard Germination Tests (%)

Germination tests were conducted in accordance with ISTA (International Seed Testing Association, 2003) criteria. Seeds were kept in between 20 x 20 cm moistened filter papers (Isolab – General Purpose 40 x 40 cm) in dark at 25ºC for 8 days and counted daily (ISTA, 2003). In present germination tests conducted in between papers (ISTA, 2008) two layers of paper were placed at the bottom, seeds were placed on these layers, another layer of paper was placed on top of seeds, papers were ~2 cm folded from the bottom corners and rolled. They were then closed to prevent loss of moisture and placed into growth chamber (Binder KBWF 240). About 6 ml distilled water was used to moisten each paper. Emergence of 2 mm rootlet was taken into consideration as the germination criterion.

Germination Rate (GR)

$$GR\ (\%) = (A/C) \times 100 \qquad \text{(Eq.2)}$$

A: Number of germinated seeds at the end of the test
C: Total number of seeds tested.

Mean Germination Time (MGT)

Mean germination time was calculated with the use of the following equation developed by Ellis and Roberts (1981).

$$MGT\ (day) = \Sigma dn / \Sigma n \qquad \text{(Eq.3)}$$

MGT: Mean germination time
d: Number of days counted
n: Number of seeds germinated in day d.

Seed Moisture Balance (%)

To eliminate the initial moisture-induced differences between the seed lots, moisture content of all lots (stored lots were 10% (±1)) was brought to 13%. In this sense, seeds were first kept on moist filter papers in petri dishes for certain periods and when the desired species-specific seed moisture content was reached (Mavi et al., 2010), they were kept at 5ºC for 3 days to provide the moisture balance. The following equation was used to increase moisture.

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$$\text{Amount of water to be added (g)} = \text{Initial seed weight X } ((100 - \text{initial moisture}) / (100 - \text{moisture to be increased})) \quad \text{(Eq.4)}$$

To ensure the seed moisture balance and bring the seed moisture to desired level, seed initial moisture was determined according to gravimetric method of International Seed Testing Association (ISTA). Accordingly, 2 g seed samples were weighed in 2 replicates to get initial weights and the seed lots of all treatments were dried at 130ºC for 1 hour (High temperature oven method) (Memmert UNE 600) (ISTA, 2008). Seed samples were removed from the oven, cooled in a desiccator for about 30 minutes, then final weights were determined. The following equation was used to determine the moisture content.

$$\text{Moisture content (\%)} = ((\text{ISW-FSW}) / \text{ISW}) \times 100 \quad \text{(Eq.5)}$$

ISW: Initial seed weight
FSW: Final seed weight.

Electrical Conductivity (*µs . cm^{-1} . g^{-1})

The seeds, the humidity of which was increased to 13%, were weighed in 4 replicates as to have 50 seeds in each replicate, they were placed in 500 mL glass beakers containing 250 ml distilled water and each beaker was closed with aluminum foil and placed into a growth chamber (Binder KBWF 240). Test materials were kept in dark conditions at 20°C for 24 hours. Then, the electrical conductivity values of the solutions were measured with the use of an EC-meter (CD-2005 Selecta). Resultant electrical conductivity values (µS . cm^{-1}) were subtracted from the electrical conductivity of test solution (should be less than 5 µS . cm^{-1}). The resultant value was divided by seed weight to get the electrical conductivity of the substances leaking from 1 gram seed (µS . cm^{-1} . g^{-1} seed) (Sivritepe at al., 2015).

Controlled Deterioration Test (%)

Controlled deterioration tests were conducted in 4 replications, each of having 25 seeds with equal moisture content. Seeds were placed in moisture-proof packages with aluminum mixture and hermetically sealed. Packages were kept under stress conditions (%20 seed moisture content and 45 °C (Memmert BE500) for 48, 72, 96 and 120 hours) (Mavi and Demir, 2007). Then, the seeds were taken to germination tests under the most suitable germination conditions according to ISTA rules (*Figure 2*). At the end of the germination test, normal and abnormal seedling ratios were determined (ISTA, 1995, 2012; Powell, 2006).

Emergence Rate (%) and Mean Emergence Time (day)

Emergence tests were conducted in a growth chamber (Binder KBWF 240) at 21±0.5ºC temperature, 75% relative humidity and 12:12 light:dark photoperiods. Tests were conducted in 4 replications with 50 seeds in each replicate. The seeds were sown to a depth of ~3-4 cm in peat-filled (Terraplant Compo) seedling multipots and placed into the growth chamber. Cotyledon leaves parallel to peat surface were accepted as emergence criteria. Emergences were countered daily and experiments were terminated when there was no emergence in 3 consecutive days. At the end of the experiment, seedlings were evaluated as normal and abnormal (Demir and Mavi, 2008).

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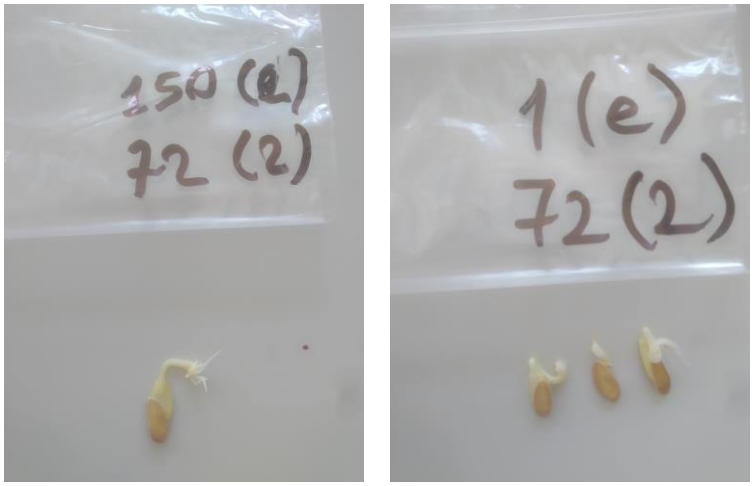

Figure 2. *Seedling samples from controlled deterioration tests 72 hours (%150 and %100 irrigation treatments)*

Peat- filled; Total nitrogen 80-280 mg/l, Water-soluble phosphorus 100-350mg/l, Water-soluble potassium 200-400mg/l, Organic matter 80%, pH 5.0-6.5, Humidity 65%, Salinity 0.7-1.8 g/l.

Mean emergence time

Mean emergence time was calculated in accordance with Ellis and Roberts (1981).

$$MET = \Sigma Dn / \Sigma n \quad \text{(Eq.6)}$$

n: Number of emerged seeds in day D
D: Number of days counted from the beginning of emergences.

Statistical Analysis

Statistical analyses were conducted with the use of SPSS statistical software. While the controlled deterioration test was subjected to analysis of variance, only seed lots were compared. In this test, each time was considered as a separate test. Germination rate, controlled deterioration test and emergence test data were subjected to Arcsin transformation before the statistical analyses. Significant data were compared with the use of Duncan's test (0.05).

Results and Discussion

Seed Color (L value, chroma, hue°)

Color parameters (L, chroma and hue°) are shown in *Table 3*. In terms of color parameters, irrigation treatments were not found to be significant. However, storage was found significant for chroma ($p \leq 0.01$) and hue° ($p \leq 0.05$).

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Table 3. *Effects of experimental treatments on color parameters*

TREATMENTS		L	Chroma	Hue°
Irrigation levels	50%	67.11	22.26	82.49
	100%	66.07	22.96	81.38
	150%	65.61	21.43	80.84
Storage	fresh seeds	66.33	21.45 b	82.75 a
	stored seeds	66.20	22.98 a	80.39 b
Irrigation levels		n.s.	n.s.	n.s.
Storage		n.s.	**	*
I X S		*	n.s.	*
Std. Dev		2,76	1,51	2,35

n.s.: not significant, *: p≤0.05, **: p≤0.01, Std. Dev.: Standard Deviation

In terms of interactions of the treatments, both L and hue° were found significant at p≤0.05 level.

The highest L value was obtained from the stored seeds subjected to 50% irrigation level and the lowest L value was obtained from the stored seeds subjected to 100% irrigation level (*Fig. 3*).

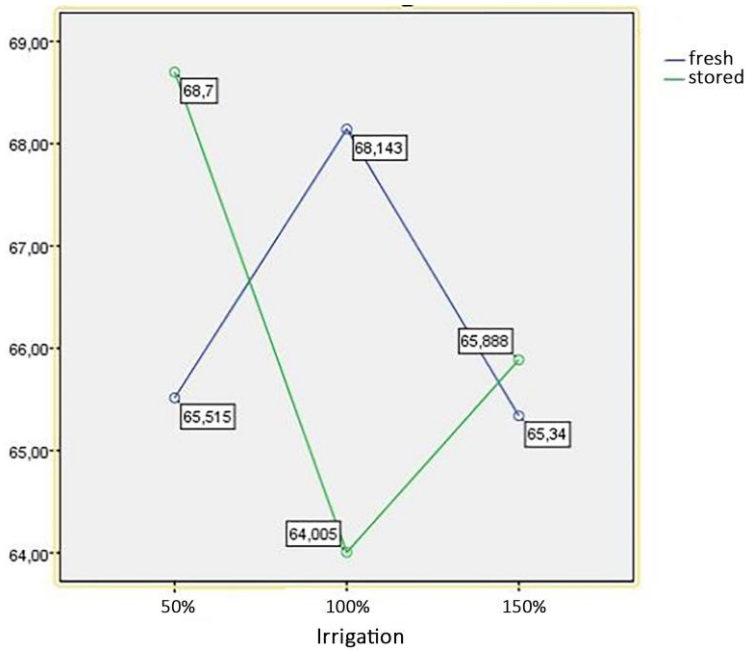

Figure 3. *Interaction graph for L value*

Chroma value was calculated as 22.98 for fresh seeds and 21.45 for stored seeds, forming two different groups. Contrary to chroma value, effects of storage treatment on hue° were higher in fresh seeds (82.75) than the hue° of stored seeds (80.39).

Interaction effects of experimental treatments on hue°, the highest value (83.61) was obtained from fresh seeds at 100% irrigation level. The lowest value (79.15) was obtained from stored seeds subjected to 100% and 150% irrigation levels (*Fig. 4*).

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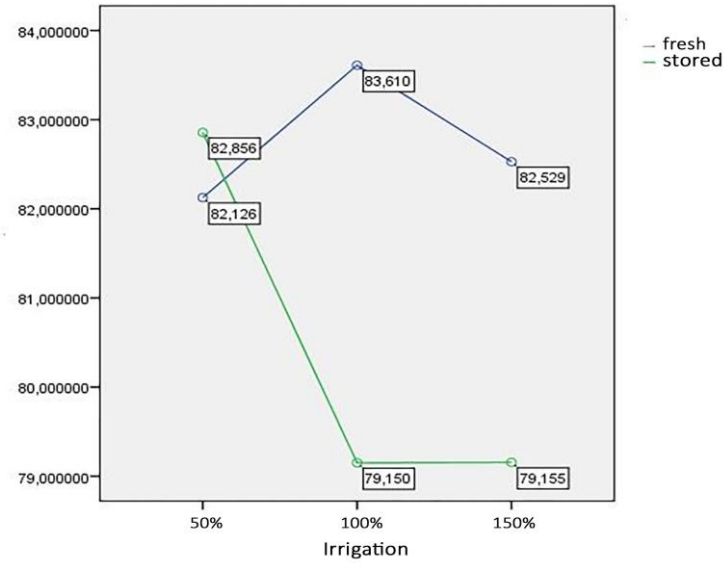

Figure 4. *Interaction graph for hue°*

Although the interaction was found significant for L value, indicating brightness - darkness of the color, the values were quite close to each other. Chroma values revealed more saturated color tones in stored seeds. Present hue° values revealed that seed colors were between yellow and orange, but closer to yellow. As compared to fresh seeds, stored seeds were closer to orange. In a previous study, aging-induced darkening - browning was encountered in red clover seeds (Velijević et al., 2017).

Mallek et al. (2017), stated that the color characteristics of melon seeds vary depending on both the variety and growing conditions, and the "a" value, which affects the chroma and hue values, is also affected by the storage period. Seed color has an importance as it affects the many factors but most importantly germination rate and mean germination time (Gairola et al., 2017).

Standard Germination Test (%)

Germination Rate (GR) (%); According to variance analysis for gemination rate of Hırsız Kaçıran melon seeds subjected to different irrigation water levels and storage conditions, storage treatments were found significant ($p \leq 0.05$), but irrigation water levels and irrigation x storage interactions were found insignificant (*Table 4*). Germination rate of stored seeds (96.08%) was greater than that of fresh seeds (85.62%).

Nerson (2002) conducted a study on watermelon seeds and reported that immature seeds harvested 28 days after flowering lost their germination ability after only 4-5 years of storage, but mature seeds (harvested 42-49 days after flowering) fully retained their germination potential even after 10 years of storage. In our study, seeds were harvested between 40-45 days and mature seeds were obtained. Therefore, stored seeds yielded high germination rates. The lower germination rates of fresh seeds could be attributed to negative effects of on-going climatic factors on agricultural practices of that year. Short-term dormancy, especially encountered in Cucurbit seeds, may have caused the seeds not to perform fully in germination of fresh seeds. Previous researchers, mentioning short-term dormancy in cucurbit seeds, indicated better test results for stored seeds (Nerson, 2007).

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Table 4. *Effects of experimental treatments on germination parameters*

TREATMENT		Germination Rate (%)	Mean Germination Time (day)
Irrigation Levels	50%	90.06	1.88 a
	100%	92.50	1.91 a
	150%	90	1.72 b
Storage	fresh seeds	85.62 b	1.87
	stored seeds	96.08 a	1.80
Irrigation Level		n.s.	*
Storage		*	n.s.
I X S		n.s.	n.s.
Std. Dev		9,77	0,15

n.s.: not significant, *: p≤0.05, **: p≤0.01, Std. Dev.: Standard Deviation

Mean Germination Time (MGT) (day); Mean germination times obtained from different treatments are given in *Table 4*. In terms of mean germination times, storge treatments and irrigation x storage interactions were not found significant, but irrigation levels were found significant at $p \leq 0.05$ level. The lowest mean germination time (1.72 days) was obtained from 150% irrigation level, followed by 50% irrigation level (1.88 days) and the greatest value (1.91) was obtained from 100% irrigation level.

Hatzig et al. (2018) investigated the effect of drought stress on the mean germination time of different canola accessions. Mean germination time was higher in Okkai 3-Go, Pollen and Zephir seeds as a result of drought treatment, while mean germination time was higher in Musette and NK Nemax seeds in control treatments.

Seed Moisture Balance (%)

Initial moisture values were determined to ensure moisture balance of the seeds to be tested and results are shown in *Table 5*. While irrigation levels and irrigation x storage interactions were not found significant, storage treatments were found significant at $p \leq 0.01$ level. The lowest moisture level (8.17%) was observed in fresh seeds stored seeds had a moisture level of 11.18%, forming a separate group.

Table 5. *Effects of experimental treatments on initial moistures and electrical conductivity*

TREATMENTS		Moisture (%)	EC ($\mu s \cdot cm^{-1} \cdot g^{-1}$)
Irrigation Levels	50%	8.81	12.60
	100%	9.53	14.32
	150%	10.69	11.47
Storage	fresh seeds	8.17 b	12.86
	stored seeds	11.18 a	12.73
Irrigation Level		n.s.	n.s.
Storage		**	n.s.
I X S		n.s.	n.s.
Std. Dev		2,28	2,75

n.s.: not significant, *: p≤0.05, **: p≤0.01, Std. Dev.: Standard Deviation, Std. Dev.: Standard Deviation

As stated in the Materials and Methods section, moisture level of the seeds to be stored was brought to 10% (±1) level and stored in moisture-proof packages to preserve

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their moisture levels. On the other hand, following the post-harvest cleaning processes, fresh seeds were dried at room temperature and no adjustments were made on their moisture levels. Mavi and Demır (2007) reported seed moisture contents of Kırkağaç melons as between 4.1 - 9.1%. Mallek-Ayadi et al. (2018) determined the moisture content as 7.16% in their study on Maazoun variety melon. Moisture values of fresh seeds were complying with previous literatures. Before to perform the seeds with known initial moisture content into the tests, moisture levels were brought to 13% and a moisture balance was then ensured.

Electrical Conductivity (µs . cm^{-1} . g^{-1})

Tissue electrical conductivity analysis results are shown in *Table 5*. Effects of experimental treatments and interactions on electrical conductivity were not found significant. The lowest electrical conductivity value (11.47 µs . cm^{-1} . g^{-1}) was obtained from 150% irrigation treatments and the greatest value (14.32 µs . cm^{-1} . g^{-1}) was obtained from 100% irrigation treatments.

Controlled Deterioration Test (%)

Controlled deterioration tests were applied for 4 different periods and resultant data are given in *Table 6* and *Table 7*. According to results of standard germination test conducted on seeds kept under stress conditions for 48 hours, normal seedling ratios varied between 71.25 - 92.50%. However, both treatments and interaction of experimental treatments were not found significant. Abnormal seedling ratios were found significant at $p \leq 0.05$ level only in terms of storage treatments.

Table 6. *Response of experimental treatments to controlled deterioration test (48-72 hours*

TREATMENTS		48-hour normal seedling ratio (%)	48-hour abnormal seedling ratio (%)	72-hour normal seedling ratio (%)	72-hour abnormal seedling ratio (%)
Irrigation Levels	50%	86.25	6.25	73.75	12.50 b
	100%	85.75	11.25	78.25	13.37 b
	150%	71.25	20.00	65.00	27.50 a
Storage	fresh seeds	76.67	17.50 a	74.17	19.17
	stored seeds	85.50	7.50 b	70.50	16.42
Irrigation Level		n.s.	n.s.	n.s.	*
Storage		n.s.	*	n.s.	n.s.
I X S		n.s.	n.s.	n.s.	n.s.
Std. Dev		16,95	12,60	19,65	13,17

n.s.: not significant, *: p≤0.05, **: p≤0.01, Std. Dev.: Standard Deviation

The abnormal seedling ratio was 7.50% in stored seeds and 17.50% in fresh seeds. As it was in seeds exposed to stress conditions for 48 hours, normal seedling ratios were not found significant as in seeds exposed to stress conditions for 72 hours. Effect of irrigation levels on abnormal seedling ratios were found significant at $p \leq 0.05$ level. Increasing abnormal seedling ratios were observed with increasing irrigation levels and the values formed two different groups. The lowest abnormal seedling ratios were observed in 50 and 100% irrigation levels respectively with 12.50% and 13.37%. The abnormal seedling ratio at 150% irrigation level was identified as 27.50%.

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Table 7. *Response of experimental treatments to controlled deterioration tests (96-120 hours*

TREATMENTS		96-hour normal seedling ratio (%)	96-hour abnormal seedling ratio (%)	120-hour normal seedling ratio (%)	120-hour abnormal seedling ratio (%)
Irrigation Levels	50%	63.75	26.63	58.75	17.50
	100%	57.50	28.75	36.75	13.75
	150%	58.75	20.00	51.88	11.25
Storage	fresh seeds	45.00 b	31.08	33.75 b	14.17
	stored seeds	75.00 a	19.17	64.50 a	14.17
Irrigation Level		n.s.	n.s.	n.s.	n.s.
Storage		**	n.s.	*	n.s.
I X S		*	*	n.s.	**
Std. Dev		27,19	16,01	29,34	11,58

n.s.: not significant, *: p≤0.05, **: p≤0.01, Std. Dev.: Standard Deviation

The data for the rest hours are given in *Table 7*. In terms of normal seedling ratio at 96-hour stress conditions, storage treatments were found significant at *p≤0.01* level. While the normal seedling ratio was 75% in stored seeds, the value was 45% in fresh seeds. Interactions of experimental treatments were found significant at *p≤0.05* level.

Interaction graph (*Fig. 5 and Fig. 6*) revealed that stored seeds had greater germination rates at 150% irrigation, fresh seeds at 100% irrigation and stored seeds at 50% irrigation. The lowest normal seedling ratio (35%) was observed in stored seeds subjected to 150% irrigation level. Similarly, in seeds subjected to stress conditions for 96 hours, only the interaction of experimental treatments was found significant for abnormal seedling ratio (*p≤0.05*). The lowest abnormal seedling ratio (10%) was obtained from the stored seeds subjected to 50% irrigation level. The greatest values at 50% irrigation level were obtained from fresh seeds, the highest values at 100% irrigation level were obtained from stored seeds and the highest values at 150% irrigation level were obtained from fresh seeds.

In terms of normal seedling ratios of seed lots subjected to stress conditions for 120 hours, storage treatments were found significant (*p≤0.05*). The normal seedling ratio was measured as 43.70% in fresh seeds and 64.50% in stored seeds. In terms of abnormal seedling ratios, irrigation level x storage interactions (*Fig. 7*) were found significant (*p≤0.01*). The lowest abnormal seedling ratio (5%) was observed in stored seeds subjected to 50% irrigation level and fresh seeds subjected to 150% irrigation level. The highest abnormal seedling ratio was obtained from fresh seeds at 50% irrigation level, stored seeds at 100% irrigation level and fresh seeds at 150% irrigation level.

As compared to germination rates before the controlled deterioration, following the irrigation and storage treatments, germination loss was encountered in controlled deterioration tests. Number of normal seedlings decreased with increasing duration of exposure to controlled deterioration. Similar fluctuations between treatment durations were also reported by Mavi and Demir (2007).

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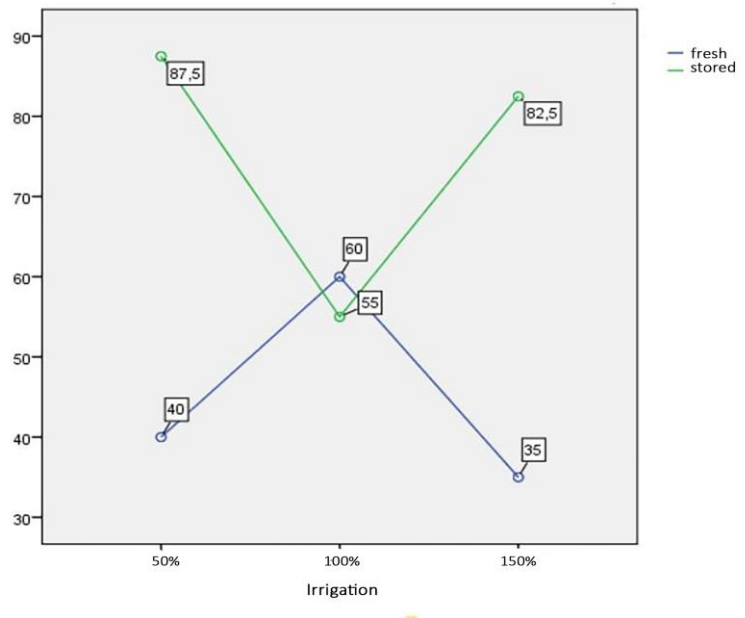

Figure 5. *Interaction graph for normal seedling ratio of controlled deterioration test (96 hours)*

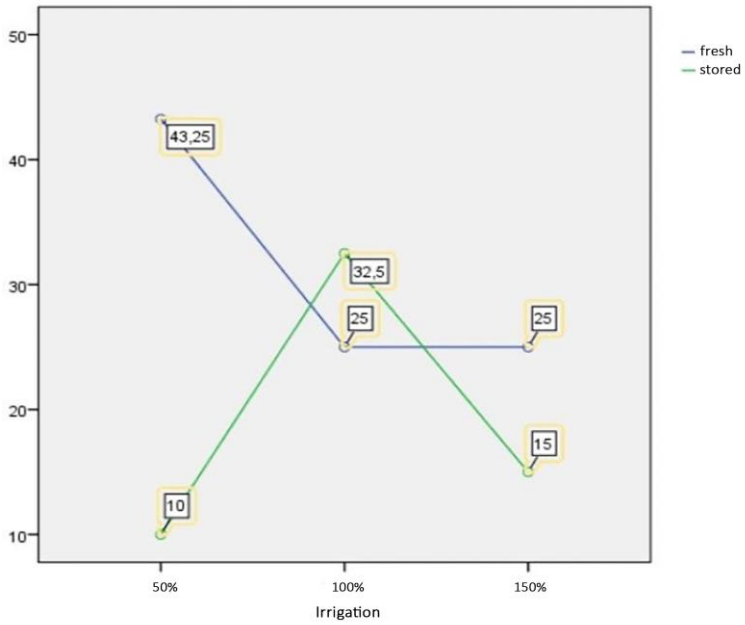

Figure 6. *Interaction graph for abnormal seedling ratio of controlled deterioration test (96 hours)*

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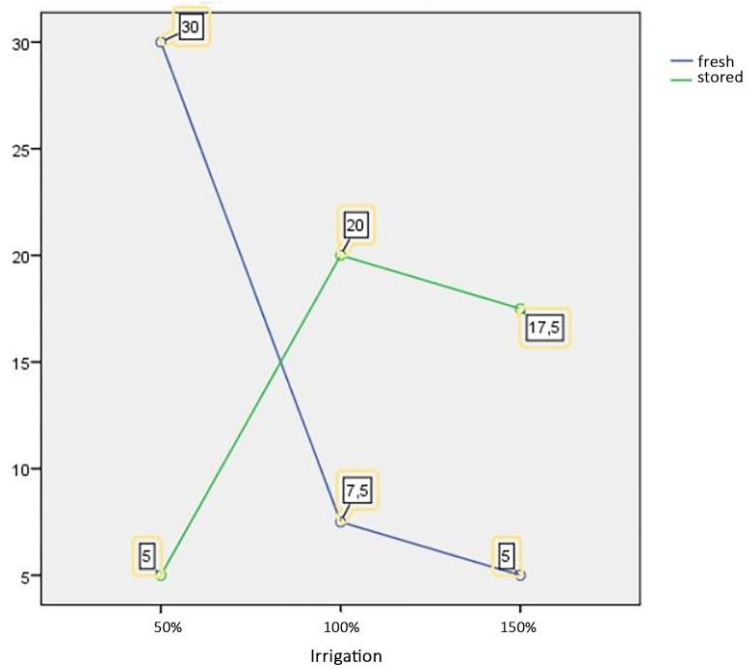

Figure 7. *Interaction graph for abnormal seedling ratio of controlled deterioration (120 hours) test*

Germination rate of vegetable seeds should be at least 75% (certified) – 80% (original) (Tarım and Bakanlığı, 2008). After 48 hours of controlled deterioration test, the germination rate of melon seeds irrigated at 150% irrigation level decreased by 20% to below 75%. After 72 hours of stress treatments, germination ratio of the seeds subjected to 50% irrigation level decreased below 75%. Mavi and Demir (2007) studied under similar conditions like this study and indicated that 48-hour stress treatments could be used in seed-aging. However, in our study, 85-86% germination rate was achieved in 48-hour controlled deterioration tests at 50% and 100% irrigation levels and sufficient aging was detected in longer stress durations.

Time-dependent changes were encountered in response of stored seeds to controlled deterioration tests. Stored seeds still had a high germination rate after 48 hours of controlled deterioration test. However, germination rate fluctuated throughout the test periods. As compared to initial values, about 2% germination loss was encountered at 120-hour controlled deterioration test. Fresh seeds, on the other hand, exhibited greater deterioration and had a germination rate of over 75% only after 48 hours of testing. The highest deterioration in fresh seeds was observed after 120 hours of testing as 60% loss in germination. The researchers noted that low germination of seed lots after the controlled deterioration test indicated low viability (Matthews, 1980; Matthews and Powell, 1981). Demir and Özçoban (2007) indicated that melon seeds still perform 90% germination after 5 years of storage at 20°C and 5% moisture content. Cucurbit seeds can be expected to show less loss of germination under suitable storage conditions.

Emergence Rate and Emergence Time (%)

In present study, emergence tests were conducted in peat media and emergence rate and time were determined (*Table 8*). Emergence rate tests were conducted by

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considering number of normal / abnormal seedlings, but no abnormal seedlings were detected. In terms of emergence rate, both treatments were found insignificant, but interactions of experimental treatments were found significant at $p \leq 0.01$ level.

Table 8. *Effects of experimental treatments on emergence parameters*

TREATMENTS		Emergence rate (%)	Mean emergence time (day)
Irrigation Levels	50%	92.50	4.02
	100%	82.50	3.91
	150%	81.25	4.06
Storage	fresh seeds	83,33	4.02
	stored seeds	87.50	3.98
Irrigation level		n.s.	n.s.
Storage		n.s.	n.s.
I X S		**	n.s.
Std. Dev		12,85	0,14

n.s.: not significant, *: p≤0.05, **: p≤0.01, Std. Dev.: Standard Deviation

Interaction graph (*Fig. 8*) revealed that the greatest germination was achieved in stored seeds subjected to 50% irrigation level, thus it could be stated that seed storage at this irrigation regime did not result in negative outcomes. Considering 100% irrigation levels, it was observed that storage treatments did not negatively affect emergence. However, positive outcomes were achieved from the storage of the seeds subjected to 150% irrigation level. Delay in the seedling emergence time and decrease in the seedling emergence rate lead to non-uniform cultivation, which adversely affects the yield (Lawles et al., 2012). However, in our study, it was determined that the seeds obtained from over or deficit irrigation levels could be stored without significant loss in emergence rate.

Mean emergence time; variance analysis to determine the effects of experimental treatments on mean emergence times revealed that both treatments and interactions were insignificant. Mean emergence times varied between 3.85 - 4.09 days (*Table 8*).

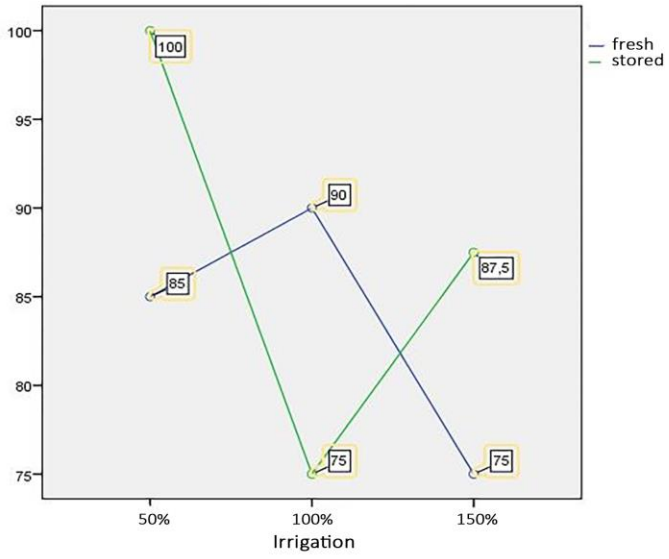

Figure 8. *Interaction graph for emergence rate*

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Conclusion

Performance of cultivars resistant to stress conditions has always attracted the attention of researchers. However, it is not solely enough to obtain high quality and productive fruits under stress conditions. It is of great importance that the seed, which is a costly starting material, should be of high quality and maintain its quality for a long time in order to sustain vegetable production. Germination rate and emergence rate were not adversely affected by irrigation conditions and such a case indicated that seed production could be achieved under these conditions. On the other hand, low irrigation levels negatively influenced mean germination time of the seeds. Such a case then caused delays in germination and emergence. Seed lots produced with low irrigation level were found to be more resistant to vigour loss in controlled deterioration tests as compared to the seeds subjected to the other irrigation levels.

Storage treatments influenced hue and chroma values, thus darkened the seed color. Irrigation levels did not result in significant losses in color parameters. However, it should be considered that such a case was also influenced by factors such as effect of climatic factors and biotic factors on seed quality, ability of cucurbit seeds to maintain their viability for many years under suitable conditions and quality of the seeds.

It was concluded based on findings that, seeds of the Hırsız Kaçıran melon landrace able to maintain most of the seed quality traits and could be stored at 10± RH seed moisture (4℃ temperature) conditions for approximately 5 years without significant loss of vigor. On the other hand, it can be suggested that, at least seeds of Hırsız Kaçıran genotype did not affected negatively while grown in different irrigation regimes and seed quality does not deteriorate.

It can be suggested to evaluate the potential of transferring genetic characteristics to other plants of the population, which was determined to be able to obtain quality products in arid conditions and can be stored without loss of vigor under producer conditions.

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