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Farklı Sulama Seviyeleri ile Yetiştirilen Hırsız Kaçıran Kavun Populasyonu Tohum ve Fidelerinde NaCl'nin Etkilerinin Belirlenmesi

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Özet

Bu çalışma, Çanakkale Biga yöresinden temin edilen yerel kavun populasyonu olan "Hırsız Kaçıran" kavununun farklı sulama koşullarından elde edilen tohum ve fidelerinin performanslarının belirlenmesi amacıyla yürütülmüştür.

Farklı sulama rejimleri uygulanan kavunlar açık arazi koşullarında, A sınıfı buharlaşma kabından meydana gelen buharlaşmanın Kp1= 0,50, Kp2= 1,00, Kp3= 1,50 katsayıları ve örtü yüzdeleri ile düzeltilerek tespit edilen sulama suyu miktarı uygulanarak yetiştirilmiştir. Her bir sulama katsayısındaki parsellerde bulunan bitkilerde; antesis döneminde tesadüfi olarak işaretlenen meyvelerde 40 gün sonra hasat yapılmış ve tohumlar çıkarılmıştır. Elde edilen tohumlar tohum ve fide çalışmasında kullanılmak üzere iki gruba ayrılmış 4 tekerrürlü ve her bir tekerrürde 50 tohum olacak şekilde gruplandırılmış ve NaCl'nin 4 farklı dozu (50mM-100mM-150mM-200mM) çimlendirme ve gerçek yapraklı fide döneminde uygulanmıştır. Araştırmada; çimlenme oranı, hipokotil boyu, kök boyu, fide boyu, fide çapı, fide yaş ve kuru ağırlıkları, nispi büyüme oranı, yaprak alanı, yaprak rengi, toplam klorofil miktarı, membran sızıntısı miktarları belirlenmiştir.

Çalışma sonunda elde edilen veriler "Minitab 16" istatistik paket programıyla değerlendirilmiş ve ortalamalar arası farklılıklar ise MSTAT-C bilgisayar programında, 0.05 önemlilik seviyesinde LSD Testi ile belirlenmiştir. Deneme sonunda; çimlenme oranının artan NaCl dozu ile azaldığı ancak farklı sulama katsayıları uygulanan fide gruplarının analiz sonuçlarında ise en iyi bitki gelişimini 1 katsayılı sulamanın gerçekleştirdiği, sulama katsayısı düştükçe fide çapında azalma olduğu tespit edilmiştir.

Anahtar Kelimeler: *(Cucumis melo L.)*, sulama, NaCl, tohum, fide

Effects of NaCl on the Seed and Seedlings of "Hırsız Kaçıran" Melon Grown in Different Irrigation Levels

Abstract

This research was carried out to evaluate seed and seedling performances of native melon population named "HirsizKacıran", obtained from Canakkale-Biga district under NaCl stress.

First research was established in open field conditions and the amount of irrigation water was applied to the plots which was determined by the multiplication of evaporation from the class-A pan and the coefficients of Kp1=0.50, Kp2=1.00, Kp3=1.50. In each plot flowers at the anthesis signed randomly which were harvested after 40days and after obtained seeds divided into two group for seed germination and seedling growth. Reseach was laid out with four replication and 50 seeds in each replication. Four NaCl doses (50mM-100mM-150mM-200mM) applied at seeds at germination and seedlings at real leaf stage and germination ratio, hypocotyl, root and seedling length, seedling diameter, fresh and dry seedling weight, relative growth ratio, leaf area, leaf colour, total chlorophyll and membran leakage was determined.

Data were evaluated with "Minitab 16 "statistical programme and differences among means determined with LSD test in 0.05 significance level. Evaluated results showed that; germination ratio decreased related to high NaCl dose however, seeds obtained from the Kp2 irrigation level (Kp2=1.00) showed higher seedling growth performance.

Key Words: *(Cucumis melo L.)*, irrigation, NaCl, seed, seedling

INTRODUCTION

1708415 tonnes of melon production in Turkey in 2012 [1].

Turkish local melon genotypes have been collected for use in breeding programs where reasonable collection of germplasm exist at Aegean Agricultural Research Institute-Izmir, Turkey, Cukurova University Faculty of Agriculture, Department of Horticulture-Adana, Turkey and Yuzuncu Yil University Faculty of Agriculture, Department of Horticulture-Van, Turkey [16, 29, 30, 31, 35].

Abiotic stress is the primary cause of crop loss worldwide, reducing average yields for most major crop plants by more than 50% [6].

Irrigation with saline water has some eff ects on the growth, production and quality of crop plants throughout the world [22].

Drought stress, which is a natural stress factor, has the highest percentage with 26% part when the usable areas on the earth are classified in view of stress factors. It is followed by mineral stress with 20%, cold and freezing stress with 15%. Whole the other stresses get 29% [4].

Agricultural regions affected by drought can experience yield loss up to 50% or more. Developing crops that are more tolerant to water deficits, while maintaining productivity, will become a critical requirement for enhancing agriculture in the twenty-first century. Understanding how plant cells tolerate water loss is a vital prerequisite for developing strategies that can impact agricultural and horticultural crop productivity and survival under these conditions of decreasing water availability [32].

Therefore drought stress is one of the most widespread environmental stresses, which affects growing and productivity; it induces many physiological, biochemical and molecular response on plants, so that plants able to develop tolerance mechanisms which will provide to be adapted to limited environmental conditions [3].

Soil salinity represented as excess amount of NaCl accumulation in sand and soils that contain soluble NaCl or exchangeable sodium with level able to harm plants [34]. Generally soils has NaCl more than 4 $mmhos.cm^{-1}$ in saturation extract defined as salty [15].

Melon salinity tolerance has been studied by several researchers [27, 21, 23, 24, 25, 28]. The results showed that melons can moderately tolerate water salinity, and that soluble solid content rose as water salinity increased. However, fruit size and yield were reduced by saline water [27].

One major constraint to seed germination is soil salinity which is a common problem in irrigated areas with low rainfall [17]. Soil salinity may effect the germination of seed either by creating an osmotic potential external to the seed preventing water uptake, or through the toxic effects of Na and Cl ions on the germination seeds [18].

One of the basic abiotic stresses is salinity which is particularly effective in arid and semi-arid regions [9].

A greenhouse experiment was conducted to assess the effect of water stress on two leguminous *(Phaseolus vulgaris)* and *(Sesbania aculeata)* species. Two watering treatments were (full field capacity and 60% field capacity) applied in trial. Plants harvested and measured for biomass and chlorophyll content on leaves after 45 days of stress application. Fresh and dry weights of stem and root, leaf area, stem length decreased compared to control plants. At result water deficit did not cause any significant effect on chlorophyll contents or chlorophyll a/b ratio [3].

According to a research dry weight of plants changed between %56 and %60 after drought stress but in well watered plants this rate was only %20 [14].

Franco [10], suggested that germination rate, plant length, fresh and dry weight and leaf area decreases on Revigal melon variety after salt stress applied at different development stages. K amount decreased depending on Na and Cl ions accumulated at leafs and reduction at fruit number and diameter. After the experiment made in aquaculture, found that high salt concentrations negatively affect to economic production and Revigal melon variety was moderately tolerant to salt stress.

Bolarín [5], observed higher salt tolerance in tomato plants that were treated at the germination stage than in plants treated after emergence. In this study, a 5 M NaCl solution was used for seed trimming of Rio Grande and H-2274 tomato cultivars, and 0 mM, 100 mM, and 200 mM NaCl solutions were used in salinity experiments to evaluate the variations in element, carbohydrate, and chlorophyll contents of the tomato cultivars.

Germination is affected negatively by salinity and drought conditions on sunflower seeds. While low amount of NaCl affected pozitively to root and stem length, it affected negatively to germination time. Germination observed in all NaCl applications but no germination in -1.2 MPa PEG application. As a result, osmotic affect can be more effective than salt toxicity [19].

Kusvuran [20], determined to effects of drought and salt stresses on growth, stomatal conductance, leaf water and osmotic potentials of melon *(Cucumis melo L.)* genotypes (sensitive, CU 40 and CU 252; resistant CU 196 and CU 159). In study, 200 mM NaCI was used for salinity stress and drought stress was achieved by decreasing irrigation water gradually and finally irrigation was completely stopped. At the end of the experiment; shoot dry weight, osmotic potential, leaf water potential and stomatal conductance were lower in salt and drought-sensitive genotypes (CU 40 and CU 252) than the resistant ones (CU 159 and CU 196). The results showed that resistant melon genotypes have more efficient stress protection mechanisms to survive under salinity and drought conditions.

A study was conducted for determining to response of dill *(Anethum graveolens L.)* to salt stress during germination and vegetative stages. Results showed germination rate and percentage, radical, plumule length, dry weight, chlorophyll a, b and total decreased significantly with the increase of salinity levels [26].

The aim of present study was determining of various stress conditions to plant development and evaluation of local cultivars for breeding studies.

MATERIALS AND METHODS

This study was applied in the unheated greenhouse in campus of Faculty of Agriculture in Canakkale 18 Mart University. Seeds obtained from native melon population named 'HırsızKacıran' in Canakkale-Biga district in Turkey.

Melons irrigated in open field conditions according to measuring of evaporation from class-A pan and amount of irrigated water calculated with the coefficients of Kp1=0.50, Kp2=1.00, Kp3=1.50 [33].

Flowers signed at the anthesis and harvested after 40 days and divided into two groups for germination and seedling.

Research laid out by four replication with 50 seeds in each replication. Four levels of NaCl (50mM-100mM-150mM-200mM) were applied at seeds with homogenous mix of distilled water at germination and seedlings at real leaf stage. İrrigations were made on each day until water leakage seen below seedling trays. Control seeds and seedlings irrigated with distilled water instead of NaCl.

Seedlings were sown in seedling trays containing 50 pots in 13.03.2013 and peat used as growth medium in all replications.

Trays were kept in climate room and irrigated with tap water until the emergence. Plants taken to the laboratory after 32 days for physiological and chemical analysis.

In 50mM, 100mM NaCl applications were no enough material for some parameters. 150mM and 200mM NaCl applications were seedling emergence but in advancing days seedlings mostly dried and no enough material found for analysis due to hot greenhouse conditions in addition to stress applications.

Physical And Chemical Analysis of The Plants

Hypocotyl Length (mm)

Hypocotyl length of plants determined by measuring with digital calipers and means calculated.

germination ratio

Root Length (mm)

Root length of plants determined by measuring with digital calipers and means calculated.

Seedling Length (mm)

Seedling Length determined by measuring with digital calipers and means calculated.

Seedling Diameter (mm)

Seedling Diameter (mm) determined by measuring with digital calipers from the root collar and means calculated.

Fresh seedling weight (mm)

Fresh seedling weight (mm) determined by measuring with precision scales and means calculated.

Dry seedling weight (mm)

Fresh seedlings dryed in 65°C oven with air circulation until stable weight [7]. Dry seedling weight (mm) determined by measuring with precision scales and means calculated.

Relative Growth Ratio

Relative Growth Ratio determined by ratio of each unit weight of plants to total plant dry weight.

Leaf Area (mm²)

Leafs of homogenous five seedlings chosen and scanned with leaf area measure programme.

Leaf Colour (L, Chroma, Hue)

Leafs of homogenous five seedlings chosen and measured with Minolta CR-400 Chroma Meter for determining of L*(Lightness), Chroma*(Purity of Colour), Hue*(Red, Yellow, Green, Blue, and Purple) parameters.

Total chlorophyll (µg/100cm2)

Chlorophyll amount of leafs determined with the spectrometric method [12].

Non-diseased, developed and homogenous leafs collected from all applications. Leafs were carried to laboratory by containers filled with ice. 4 g of discs cut out from leafs extracted in %90 acetone and solution distilled by wattman no 2 filter paper. The solution was used for the absorption spectra from 663, 645 and 652 nm by using a UV-1800 spectrophotometer and amount of total chlorophyll, chlorophyll a and b determined as µg/100cm² with correction.

Membrane Leakage (%)

Membrane leakage or membrane injury index determined by measuring electrolyte leaking from the leafs with Hanna HI9812-5 EC meter [8, 11]; discs cut out from non-diseased, developed and homogenous leafs kept in distilled water for 5 hours and EC measured. Same discs kept in 100°C for 10 minutes and measured again with EC meter.

Table 1. Effects of NaCl applications on seedlings grown from the seeds of melons irrigated with different levels of irrigation

Parameters	LSD	Kp1=0.50			Kp2=1.00			Kp3=1.50		
		0 mM NaCl	50 mM NaCl	100 mM NaCl	0 mM NaCl	50 mM NaCl	100 mM NaCl	0 mM NaCl	50 mM NaCl	100 mM NaCl
Hypocotyl Length (mm)	ÖD	35,740	33,367	29,683	33,917	35,093	27,540	33,873	34,753	31,210
Root Length (mm)	47,36	140,64A	159,50A	37,06B	170,62A	142,23A	77,63B	146,26A	126,20A	59,32B
Seedling Length (mm)	10,69	52,27A	40,42BCD	34,19CD	52,55A	47,16AB	31,84D	42,44ABCD	43,34ABC	33,85CD
Seedling Diameter (mm)	0,6117	2,480A	1,563B	1,136B	2,853A	2,340A	1,286B	2,746A	2,390A	1,396B
Fresh Seedling Weight (gr)	1,128	3,881A	2,006CD	0,827E	3,760A	3,429AB	1,130DE	2,848ABC	2,446BC	1,108DE
Seedling Dry Weight (gr)	0,0903	0,316A	0,111CD	0,055D	0,310A	0,204BC	0,075D	0,233AB	0,151BCD	0,066D
Relative Growth Rate	0,0134	0,038A	0,016BC	0,008C	0,038A	0,036A	0,001C	0,029AB	0,025AB	0,001C
Leaf Area (mm²)	3,456	8,847ABC	6,168CD	3,642D	11,132A	6,502BCD	5,203D	9,738AB	6,302BCD	5,048D
Leaf Colour (L)	3.730	39,840B	42,483B	46,500A	38,780B	39,160B	47,210A	41,957B	41,660B	46,560A
Leaf Colour (Chroma)	6.388	30,423CD	38,753A	26,629D	31,195BCD	36,347ABC	33,059ABC	35,397ABC	37,529AB	33,590ABC
Leaf Colour (Hue)	3.730	56,081D	59,907CD	68,894AB	59,486CD	62,698BCD	70,226A	62,260BCD	63,904ABC	65,379ABC
Total Chlorophyll (µg/100cm²)	2,018	21,419A			15,234B			6,230C		
Chlorophyll a (µg/100cm²)	1,639	15,518A			11,481B			4,314C		
Chlorophyll b (µg/100cm²)	1,582	5,7974A			3,8408B			2,4031B		
Membrane Leakage (%)	0,116	4,790 C			21,168 A			15,831 B		

Table 2. Mean germination (%) of seeds obtained from melons irrigated with different levels of irrigation

LSD 2.35	0 mM NaCl	50 mM NaCl	100 mM NaCl	150 mM NaCl	200 mM NaCl
Kp1=0.50	84,60BC	47,24G	57,50F	32,46I	0,58J
Kp2=1.00	87,88A	79,58D	82,44C	79,74D	42,90H
Kp3=1.50	86,18AB	84,50BC	86,66AB	70,60E	32,30I

Membrane leaking (%) determined with formula described below.

MII=(Lt-Lc / 1-Lc) x 100

Lt: EC of applicated leaf before autoclave/EC of applicated leaf after autoclave

Lc: EC of control leaf before autoclave/EC of control leaf after autoclave

Mean Germination (%)

The germination of 4 replicates of 50 seeds from each seed lot was assessed using the between paper method [13] at 25°C in the dark. The percentage of normal seedlings [13] was determined after 8 d in melon seeds.

Statistical analiysis was conducted using the minitap 16 pocket programme and controlled by LSD test with $P \leq 0.05$ significance.

RESULTS AND DISCUSSION

Hypocotyl length were not indicate any differences statistically among applications.

Root length increased with 50 mM NaCl but decreased with 100 mM NaCl in seedlings grow from seeds of melons irrigated with 0,5 Kcp coefficient. Root length decreased with NaCl treatments in seedlings grow from seeds of well irrigated applications.

In seedlings grow from the seeds of melons irrigated with 0,5 and 1 Kcp treatments showed a higher seedling length, diameter, fresh and dry weight than other treatments statistically without NaCl applications.

Total chlorophylls were higher in seedlings grow from the seeds of melons irrigated with 0,5 Kcp coefficient.

Seedlings obtained from seeds of well irrigated melons had more membrane leakage.

In all applications lightness and hue values of leafs increased with salt stress.

Seeds obtained from well irrigated melons indicated more germination performance under stress conditions.

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