Journal of Novel Applied Sciences
Available online at www.jnasci.org
©2015 JNAS Journal-2015-4-12/1246-1248
ISSN 2322-5149 ©2015 JNAS

Effects of salinity stress on some physiological properties of almond

Aisan Ghahremanzadeh*, Saeed Piri and Ali Imani

Islamic Azad University, Abhar Branch, Abhar, Iran

Corresponding author: Aisan Ghahremanzadeh

ABSTRACT: This study was conducted to evaluation of salinity stress on some physiological properties of almond. This study was conducted as randomized factorial design at Seed and Plant Improvement Institute. Factors examined include 10 cultivars (Tuono, Sahand, 25-1, 13-40, Mamaie, Shekufeh, 1-16, A200, N.P and Sh-12) and 5 salinity levels (0, 20, 40, 60 and 80 mmol l) that each treatment was with 3 replications. Measured traits included Chlorophyll a, Chlorophyll b, Total Chlorophyll, RWC and Prolin. Result showed that all traits were reduced by salinity except of Prolin. Between cultivar, Sahand and shekufeh had highest resistance to salinity stress.

Keywords: Almond, Salinity, Chlorophyll.

INTRODUCTION

The cultivated almond (*Prunus amygdalus*) belongs to Rosaceae family, subfamily Prunoideae, and typified by a drupe fruit structure (Kester and Gradiziel, 1996). In Iran, but also in other places worldwide, almond cultivation is confined to agricultural lands characterized by continue drought, high temperatures, and low precipitation, where irrigation induces accumulation of salt in soils following a combination of sustained evaporative and transpiration water losses (Sharma and Rao 1998; Rains and Goyal, 2003). Fruit trees are generally categorized as sensitive to high levels of soluble salts, particularly to chloride, and their degree of salt tolerance also depends on the stage of growth and development (Najafian, 2008). The purpose of the present study was to evaluation of salinity stress on some physiological properties of almond.

MATERIALS AND METHODS

This study was conducted as randomized factorial design at Seed and Plant Improvement Institute. Factors examined include 10 cultivars (Tuono, Sahand, 25-1, 13-40, Mamaie, Shekufeh, 1-16, A200, N.P and Sh-12) and 5 salinity levels (0, 20, 40, 60 and 80 mmol l) that each treatment was with 3 replications. Measuring proline was conducted by Bates et al (1973) and Chlorophylls were determined by spectrophotometer (Canada, BT600 Plus). The SAS software was used for data analysis and Duncan's multiple range tests was used for the comparison of data.

RESULTS AND DISCUSSION

Chlorophyll a: results showed that cultivar and salinity stress had significant effect on chlorophyll a content. Application of 20, 40, 60 and 80mmol/l decreased 28, 49, 64 and 68% in chlorophyll a content, respectively. Highest (9.6) and lowest (6.6) means observed by Sahand and1-16, respectively. Interaction between treatments showed that salinity reduces the amount of chlorophyll a. Another character to be taken into consideration was the Chlorophyll b**,** Results showed that cultivar and salinity stress had significant effect on chlorophyll b content. Application of 20, 40, 60 and 80 mmol/l decreased 18, 43, 51 and 60% in chlorophyll b content, respectively. Highest (4.3) and lowest (1.9) means observed by N.P and1-25, respectively. Interaction between treatments showed that salinity reduces the amount of chlorophyll b. Differences in Total Chlorophyll were observed among the cultivar, Results showed that cultivar and salinity stress had significant effect at 1% on total chlorophyll content. Application of 20, 40, 60 and 80 mmol/l decreased 26, 48, 61 and 66% in total chlorophyll content, respectively. Highest (13.8) and lowest (9.4) means observed by N.P and1-25, respectively. Interaction between treatments showed that salinity reduces the amount of total chlorophyll. In this experiment, we observed differences between RWC**,** This trait was changed by treatments, treatments and them interaction had significant effect on RWC at 5% statistical level. Application of 40, 60 and 80mmol/l decreased 2, 4 and 6% in RWC, respectively. Lowest means observed by 1-16 and Shekufeh. The characters of Prolin have also been determined, Application of salinity treatments 20, 40, 60 and 120mmol/l had significant effect on prolin and these treatments showed 4, 20, 33 and 42% increasing in prolin, respectively. 1-16 and Sahand Genotypes showed highest (147mmol/1gr of FW) and lowest (122 mmol/1gr of FW) means for prolin, respectively. Dionisio-Sese and Tobita (2000) reported that the net photosynthetic rate, measured in terms of CO2 assimilation of the youngest fully expanded leaf of four rice varieties, declined with increasing level of salinity stress. They suggested that this might be due to a direct effect of salt on stomatal resistance via a reduction in guard cell turgor. Chlorophyll fluorescence is a rapid and non-intrusive tool used to screen varieties for salinity tolerance (Maxwell and Johnson, 2000). In Sorghum, Netondo et al. (2004) reported that maximum quantum yield of photosystem II (PSII; Fv/Fm), photochemical quenching coefficient (qP) and electron transport rate (ETR) significantly decreased, but non-photochemical quenching (qN) increased substantially under saline conditions. One distinctive feature of most plants growing in saline environments is the accumulation of increased amounts of low molecular weight water-soluble metabolites in their cells, such as proline (Hasegawa et al., 2000), possibly for osmotic adjustment. elevated proline levels may also confer additional regulatory or osmoprotective functions under salt stress, such as its role in the control of the activity of plasma membrane transporters involved in cell osmotic adjustment in barley roots (Cuin and Shabala, 2005). Given the fact that proline biosynthesis is a highly energy-demanding process and that only small quantities of proline are probably required for the control of plasma membrane transporters (Cuin and Shabala, 2005). This study showed that Sahand and shekufeh had highest resistance to salinity stress.

Table 1. comparison of means in response to treatments

		chlorophyll a		chlorophyll b		Total chlorophyll		Rwc		Prolin	
1-25	control	10.81	b-k	3.2	bcd	14.01	b-f	85.75	abc	112.1	f-i
	20	9.78	c-k	1.35	d	11.13	c-f	85.11	abc	125.4	b-i
	40	6.44	d-k	2.19	cd	8.63	c-f	84.51	a-d	135.2	a-i
	60	4.79	h-k	1.57	d	6.36	def	82.2	a-e	155.6	a-f
	80	3.49	jk	1.35	d	4.84	ef	80.8	b-e	162.4	a-e
N.p	control	19.24	a	9.65	a	28.89	a	86.21	ab	109.3	f-i
	20	13.9	a-f	6.85	abc	20.74	a-d	86.02	ab	112.9	f-i
	40	8.03	d-k	2.64	cd	10.66	c-f	85.45	abc	130.1	b-i
	60	3.67	ijk	1.57	d	5.25	ef	83.65	a-e	145.3	a-i
	80	2.74	k	0.97	d	3.71	f	82.05	a-e	155.6	a-f
Sahand	control	14.52	a-d	4.33	bcd	18.85	a-e	85.61	abc	105.7	ghi
	20	12.26	a-i	4.99	bcd	17.26	a-f	85.05	abc	110.3	f-i
	40	10.37	c-k	3.43	bcd	13.8	b-f	84.85	abc	121.4	c-i
	60	5.08	h-k	3.42	bcd	8.51	c-f	83.79	a-e	132.1	b-i
	80	6.15	d-k	2.04	d	8.19	c-f	83.11	a-e	142.6	a-i
Sh-12	control	11.23	a-k	3.72	bcd	14.95	b-f	86.49	ab	118.4	e-i
	20	9.83	c-k	3.53	bcd	13.37	b-f	85.91	abc	120.4	e-i
	40	8.02	d-k	2.58	cd	10.59	c-f	84.05	a-d	134.6	b-i
	60	6.04	d-k	2.72	cd	8.76	c-f	82.91	a-e	152.1	a-g
	80	5.73	e-k	2.09	d	7.81	def	80.87	b-e	160.7	a-e
13-40	control	18.68	ab	7.5	ab	26.18	ab	85.95	ab	111.7	f-i
	20	9.05	c-k	4.89	bcd	13.94	b-f	86.09	ab	120.7	d-i
	40	7.19	d-k	2.92	bcd	10.1	c-f	84.25	a-d	132.6	b-i
	60	4.88	h-k	1.75	d	6.64	def	82.12	a-e	146.9	a-i
	80	4.51	h-k	2.31	cd	6.81	def	79.91	c-f	150.2	a-g
Shekufe h	control	16.87	abc	5.5	bcd	22.38	abc	87.02	a	108.8	f-i
	20	10.21	c-k	4.69	bcd	14.9	b-f	85.14	abc	118.3	e-i
	40	5.85	e-k	2.84	cd	8.7	c-f	83.65	a-e	149.6	a-h
	60	5.19	g-k	1.77	d	6.95	def	80.81	b-e	168.6	abc
	80	4.5	h-k	2	d	6.5	def	77.94	ef	181.6	a
A200-	control	13.84	a-g	5.3	bcd	19.15	a-e	85.61	abc	100.3	i
	20	11.98	a-j	3.74	bcd	15.71	a-f	85.88	abc	102	hi
	40	8.17	d-k	4.68	bcd	12.85	b-f	84.51	a-d	125.7	b-i
	60	6.3	d-k	4.61	bcd	10.91	c-f	83.91	a-d	136.4	a-i
	80	4.56	h-k	2.36	cd	6.92	def	82.17	a-e	149.6	a-h

1-16	control	13.16	a-h	3.68	bcd	16.85	a-f	83.65	a-e	120.1	e-i
	20	9.09	c-k	3.75	bcd	12.84	bcdef	84.01	a-d	125.9	b-i
	40	5	h-k	1.6	d	6.6	def	81.09	a-e	149.7	a-h
	60	3.04	k	2.66	cd	5.69	ef	78.81	def	168	a-d
	80	2.96	k	2.5	cd	5.46	ef	75.22	f	171.9	ab
Mamaei	control	14.25	a-e	3.71	bcd	17.96	a-f	84.21	a-d	110.7	f-i
	20	9.65	c-k	4.32	bcd	13.98	b-f	84.89	abc	109.8	f-i
	40	7.29	d-k	2.44	cd	9.73	c-f	83.04	a-e	123.1	c-i
	60	6.81	d-k	2.19	cd	9	c-f	81.91	a-e	136.6	a-i
	80	6.61	d-k	2.12	d	8.73	c-f	81.14	a-e	147.9	a-h
Tuonu	control	13.09	a-h	3.49	bcd	16.58	a-f	85.59	abc	115.9	e-i
	20	8.07	d-jk	2.88	cd	10.95	c-f	85.04	abc	121.1	d-i
	40	7.08	d-k	2.89	cd	9.97	c-f	84.11	a-d	136.7	a-i
	60	5.25	f-k	2.17	d	7.42	def	83.09	a-e	149.7	a-h
	80	4.19	ijk	2.27	cd	6.47	def	82.95	a-e	161.3	a-e

REFERENCES

Baninasab B & Rahemi M. 2007. Evaluation of three wild species of almond on the basis of their morphological characters. Journal of Central European Agriculture, 7(4), 619-626.

Cuin TA, Shabala S. 2005. Exogenously supplied compatible solutes rapidly ameliorate NaCl-induced potassium efflux from barley roots. Plant and Cell Physiology 2005;46:1924-1933.

Dionisio-Sese ML, Tobita S. 2000. Effects of salinity on sodium content and photosynthetic responses of rice seedlings differing in salt tolerance. Journal of Plant Physiology;157:54-58.

Hasegawa PM, Bressan R, Zhu J-K, Bohnert H. 2000. Plant cellular and molecular responses to high salinity. Annual Review of Plant Physiology and Plant Molecular Biology 2000;51:463-499.

Kester DE, Gradziel TM. 1996. Almonds, in: Janick J., Moore J. N. (Eds.), Fruit Breeding. Vol. III. Nuts, John Wiley and Sons, New York, , pp. 1-97.

Maxwell K, Johnson GN. 2000. Chlorophyll fluorescence: a practical guide. Journal of Experimental Botany 2000;51:659-668.

Najafian S, Rahemi M, Tavallali V. 2008. Effect of salinity on tolerance of two bitter almond rootstocks. American-Eurasian J Agric Environ Sci 3:264–268.

Netondo GW, Onyango JC, Beck E. 2004. Sorghum and salinity: II. Gas exchange and chlorophyll fluorescence of sorghum under salt stress. Crop Science 2004;44:806-811.

Rains DW, Goyal SS. 2003. Strategies for managing crop production in saline environments. In: Goyal SS, Sharma SK, Rains DW C (eds) Crop production in saline environments: global and integrative perspectives. Food Products Press, imprint of the Haworth Press, Binghamton, pp 1–10.

Sharma DP, Rao KVGK. 1998. Strategy for long term use of saline drainage water for irrigation in semi-arid regions. Soil Till Res 48:287–295.