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Evaluation of inflorescence removing and salinity anti-stress matter application effects on potato, *Solanum tuberosum* (cv. Agria) yield

Ali Faramarzi[1+], Shahram Shahrokhi[1], Hadi Mehrpouya[1], Davood Hasan Panah[2]

[1] Department of Agronomy, Miyaneh Branch, Islamic Azad University, Miyaneh, Iran,
[2] Agriculture and Natural Resources Research Center of Ardabil Province.

Abstract. Effect of inflorescence removing and different concentrations of "Out Salt" salinity anti-stress matter application on yield of potato, *Solanum tuberosum* (cv. Agria) was investigated in the experimental field of Agricultural and Natural Resources Research Center of Ardebil Province during 2010. The experiment was carried out as factorial based on a randomized complete block design with three replications. Factors included removing and not removing the inflorescence and four concentrations of anti-stress matter (0, 2, 2.5 and 3 per thousand). The traits of stem numbers per plant and plant height were measured during the growing season. Number of tubers per plant, yield of marketable tubers and total yield of tubers were also measured after harvesting. The results revealed that inflorescence removing significantly increased the traits of plant height, tuber's number per plant, marketable tuber's yield, and total yield of tubers. The highest marketable tuber yield was obtained by application of 2.5 and 3 per thousand concentrations of salinity anti-stress matter. Application of anti stress matter at 2.5 per thousand concentration also increased potato yield up to 7.1 tons per hectare in comparison to the control. In conclusion, application of the anti-stress matter used in the present experiments, Out Salt, at 2.5 per thousand concentration and inflorescence removing is recommended for increasing potato yield.

Key words: Mini-tuber, Potato, Yield, Salinity, Anti-stress matter.

1. Introduction

Potato is one of the most important, the cheapest and most valuable foods over the world. Potato is cultivated in 20 million hectares in 130 countries, where three-quarters of the world's population live. The annual production of potato is 288 million tons and it is considered as world's fourth main crop after wheat, corn and rice (Farahvash, 2007).

Removing inflorescence recently have been taken into considerations for increasing potato yield. Nazari (2010) reported the effect of inflorescence removing on yield of four potato cultivars. The effect of inflorescence removing on potato yield has also been reported by other researchers (Robert and Dwelle, 1990; Fisher *et al.*, 2002; Almekinders and Struik, 2005; Tekalign, 2005). Tekalign (2005) also reported that four potato cultivars' yield increase ranged 18-22% by inflorescence removing**.**

In agro-econcosystems, plants may encounter with high salt concentrations duo to accumulation salts in the soil by water is used for irrigation. Besides, evaporation takes pure water from the soil and so, increases the concentration of salts in the soil (Abrishamchi *et al.*, 1997). Rajashekar *et al.* (1995) assessed potato varieties resistace to salinity by transferring stem, petiole and root tissues of seedlings to a solution of 2 M. NaCl with a pink test after 24 hours at 2, 3, 5 chloride three phenyl tetrazolium. They showed that high concentrations of salt reduced the percentage of plant tissues survival. Some researchers reported that 5.9 ds/m salinity level may cause 50% potato yield reduction and 10 ds/m prevented plant growth and yield, at all. Irrigation waters containing NaCl affect potato tubers directly and distrupt the plants' growth (Sadegi *et al.,* 1996). Hardan (1976) revealed that tuber production in potato significantly decreased with increasing salinity levels. Levy *et al.* (1988) also studied the effect of three salinity levels (20.5, 34.2 and 51.3 mM.

+Corresponding author. Tel.: +9809144236505 +
E-mail address: faramarzi@m-iau.ac.ir

NaCl) on six potato cultivars and concluded that salinity reduced water potential, leaf and tubers' osmotic potential and increased tubers' prolin and dry matter.

The anti-stress material used in the present experiments, Out salt, is a product used for reducing soil salinity effects. It also is used for improving soil structure to faciliate ventilation (Anonymous, 2010).

In the present study, the effect of inflorescence removing and different concentrations of "Out Salt" salinity anti-stress matter application on potato, *Solanum tuberosum* (cv. Agria) yield was investigated in a field experimen.

2. Material and methods

The experiment was carried out as factorial based on completely randomized design with three replications in the experimental field of Agricultural and Natural Resources Research Center of Ardebil Province during 2010. The first factor comprised of two levels (removing and not removing the inflorescence) and second factor included salinity anti-stress matter application at four levels (0, 2, 2.5 and 3 per thousand). Salinity was induced in three growth stages of 15 days after emergence (stolen production stage), 30 days after emergence (tubers production stage) and 45 days after emergence (mini tuber elongation stage). Weeds control and irrigation was performed regularly during the growing season. The traits of stem numbers per plant and plant height were measured during the growing season. Number of tubers per plant, yield of marketable tubers and total yield of tubers were also measured after harvesting. Data analysis by GLM procedure and mean comparison by Duncan's multiple range test was done using SAS software. Microsoft Excell software was also used for graphspreparation.

3. Results and discussion

Results of the data analysis of variance showed that the effect of inflorescence removing and anti-stress material levels was significant on all traits measured in the experiment, except stem numbers per plant. However, the effect of inflorescence removing and anti-stress material levels interaction was not significant on any studied trait (table 1).

Table 1. Mean squares of the traits studied in the experiment.

Source of variation	df	Stem numbers per plant	Plant height	Tuber numbers per plant	marketable tuber's yield	Total tuber's yield
Replication	2	0.037 ^{ns}	783.001 ^{ns}	4.38 ^{ns}	83.67 ^{ns}	43.42 ^{ns}
Inflorescence (A)	1	1.15 ^{ns}	1556.56**	3.59*	221.81**	157.02**
Anti-stress material (B)	3	3.09 ^{ns}	187.88*	7.72**	97.11**	161.19**
A*B	3	0.35 ^{ns}	125.27 ^{ns}	0.92 ^{ns}	10.07 ^{ns}	36.22 ^{ns}
Error	6	1.59 ^{ns}	53.96 ^{ns}	0.89 ^{ns}	19.81 ^{ns}	17.70 ^{ns}
Coefficient of variation (%)		17.35	19.77	9.35	22	17.87

*, ** and ns: significant at 0.05 and 0.01 probability levels and non significant, respectively.

3.1. Plant height

The results revealed that inflorescence removing increased the plant height. Application of anti-stress material at 2.5 and 3 per thousand concentration also prevented adverse effects of soil salinity, and so increased plant height (fig.1). The correlation between plant height and mini-tubers' yield was positive and significant. Increasing plant height could result in new leaves producing which increases light absorption and thus photosynthesis efficiency.

The same results has also been reported by Abdullah and Ahmad (1990), Barakat (1996), Karam *et al.* (1998), Marcony *et al.* (2001), Farhatullah and Raziuddin (2002), Djilianov (2003), Backhausen *et al.* (2005) and Kirk *et al.* (2006).

3.2. Number of tubers per plant

The number of tubers per plant significantly increased as the plants' inflorescences removed. Nazari (2010) also reported an increase in the number of tubers per plant when inflorescences were removed. Also Tekalign (2005) reported that flower and fruit production can reduce the number of tubers per plant.

Number of tubers per plant was increased by anti-stress material application. The highest mean number of mini-tubers per plant was observed at 2.5 per thousand concentration (fig.2). Thus, the results revealed that tuber production could be increased by anti-stress material application. The positive significant correlation was observed between plant height and tubers' numbers per plant. It seems that increasing plant

height caused increased number of tubers, because it could result in new leaves production which increases light absorption and thus photosynthesis efficiency.

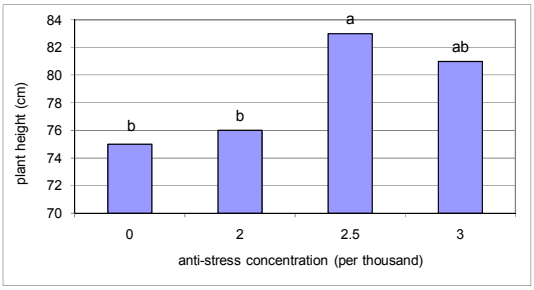

Fig.1. Average plant height at different levels of salinity anti-stress matter

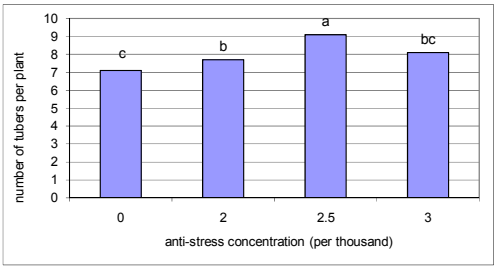

Fig.2. Number of tubers per plant at different levels of salinity anti-stress matter

3.3. Marketable and total tubers' yield

Inflorescences removing increased yield of marketable tubers and total tuber's yield. Total and marketable tubers' yield of potato increased as high as 3.62 and 4.3 ton per hectare, respectively as a result of removing an assimilate consumer organ (i.e. inflorescence).

Figures (3) and (4) represent yield of marketable tubers and total tubers' yield at different levels of salinity anti-stress matter. Application of the salinity anti-stress matter at 2.5 per thousand concentration resulted in up to 7.1 and 4.99 tons yield increase per hectare in comparison to the control, respectively .

Nazari (2010) have also reported that removing inflorescence increased potato yield up to 2.68 ton.ha-1 (8.9 percentage). The effect of inflorescence removing on potato yield has been reported by other researchers (Robert and Dwelle, 1990; Fisher *et al.*, 2002; Almekinders and Struik, 2005; Tekalign, 2005). Koucheki and Mahalati Nasiri (1994) have reported that flowers development significantly affect the available assimilates duo to changes in patterns of assimilate production and its allocation to the upper and underground plant reservoirs. Tekalign (2005) also reported that four potato cultivars' yield increase ranged 18-22% by inflorescence removing.

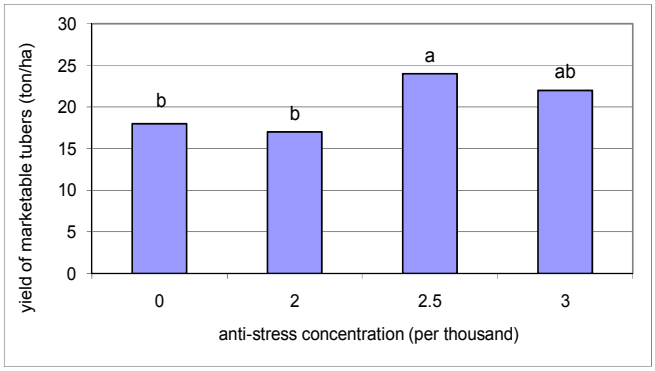

Fig.3. yield of marketable tubers at different levels of salinity anti-stress matter

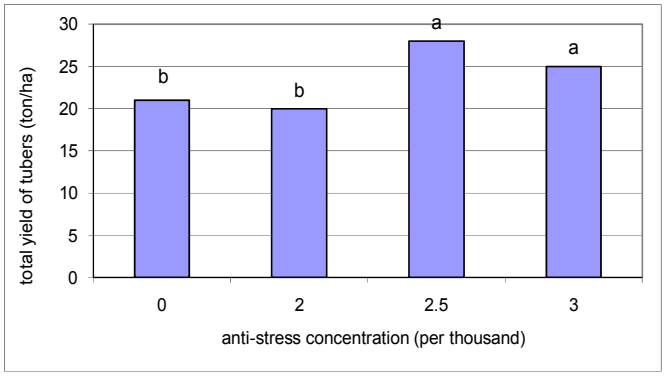

Fig.4. Total yield of tubers at different levels of salinity anti-stress matter

Salinity is one of the most important environmental stresses that can decrease potato tuber yield. Yield reduction in salinity stress condition was demonstrated by many researchers (Farhatullah and Raziuddin, 2002). In conclusion, application of the anti-stress matter used in the present experiments, Out salt, at 2.5 per thousand concentration and inflorescence removing is recommended for increasing potato yield.

4. References

[1] C.A. Abrishamchi, R. Ahmadi Moghaddam, M. Asghari, M. Link and N. Adolescent. 2007. *Plant Physiology*. Khaneye Zistshenasi,, 752 pp.

[2] Anonymous. 2010. *Salinity Stress*. www.armansabz.adinehgroup.com

[3] J.E. Backhausen, M. Kelin, M. Klock, S. Jung and R. Scheibe. 2005. Salt Tolerance of Potato (*Solanum tuberosum* L.) Plants Depends on Light Intensity and Air Humidity. *Plant Sci.* **169**:229-237.

[4] D. Djilianov, E. Prinsen, S. Oden, H. Onckelen and J. Muller. 2003. Nodulation under Salt Stress of Alfalfa Lines Obtained after *in vitro* Selection for Osmotic Tolerance. *Plant Sci.* **165**:887-894.

[5] F. Farahvsh. 2007. Effect of S*eed Size and Aerial Remove Timing on Yield and Yield Components of Agria Potato Variety*. Final Report, Islamic Azad University of Tabriz.

M. Farhatullah and R. Raziuddin. 2002. *In vitro* Effect of Salt on the Vigor of Potato. *Asian Network for Scientific Info. Biotechno.* **2**(4):73-77.

[6] A. Hardan. 1976. *Irrigation With Saline Water under Desert Conditions*. Univ. Lubbock, Texas. 169 pp.

[7] F. Karam, N. Katrji, M. Mastrorilli, J.W. Van Hoorn, A. Hamdy and R. Munozcarpena. 1998. Effect of Irrigation Water Salinity and Soil Texture on Potato Growth and Production. *Acta Horti*. **458**:89-94.

[8] W.W. Kirk, A.B. Rocha, S.I. Hollosy and P.S. Wharton. 2006. Effect of Soil Salinity on Internal Browning of Potato Tuber Tissue in Two Soil Types. *American. J. Potato Res.* **83**:223-232.

[9] D. Levy, E. Fogelman and Y. Itzhak. 1988. The Effect of Water Salinity on Potatoe (*S. tuberosum* L.): Physiological Indices and Yielding Capacity. *Potato Res*. **31**(4):601-610.

[10] P. Marcony, M. Benavides and O. Caso. 2001. Growth and Physiological Characterization of Regenerated Potato *Solanum tubersum* Plants Affected by NaCl Stress. *New Zealand J. Crop Horti. Sci*. **29**:45-50.

[11] L. Nazari. 2010. *Effect of inflorescence removing on yield and yield components of four potato cultivars in Ardebil region, Iran*. M.Sc. Thesis in Agronomy, Miyaneh Branch, Islamic Azad University, 89 pp.

[12] B.Robert and B. Dwelle. 1990. Source/sink relationships during tuber growth. Amer. *Potato J.*, **67**:829-833.

[13] A. Sadeghi, M. Butson, R. Asghari and D. Zakaria. 2006. *Evaluation of Promising Potato Varieties Tolerance to Ssalinity*. M.Sc. Thesis, Islamic Azad University of Ardabil, 92 pp.

[14] T. Tekalign. 2005. Growth and productivity of potato as influenced by cultivar and reproductive growth: I. Stomata conductance, rate of transpiration, net photosynthesis and dry matter production and allocation. *Sci. Horti*. **105**:13-27.