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POTATO PRODUCTION UNDER BRAKISH WATER AND COMPOST USE

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Abstract

The non-linear transition to adulthood of today's youth signaled by numerous theoreticians has consequences on the forms of political participation favoured by young people. Nevertheless, citizenship education continues to play a significant role in shaping the political behaviour of future adults. After highlighting the characteristics of citizenship education in Europe as outlined in the most recent Eurydice study (2012) and briefly presenting the alternative forms of political and social participation embraced by the young generation, the present paper aims to determine the level of interest and involvement of Romanian teenagers in political and social activities at both national and European level. The research method employed is a quantitative one, pupils from the 11th and 12th- grade being the subjects of a survey conducted in six Romanian high schools. Findings reveal that although teenagers are willing to make their voice heard by various means, including alternative forms of participation, they still trust the effectiveness of electoral forms of participation in influencing the decision-making process and are eager to exercise the democratic right of voting.

Keywords: Keywords: potato, brackish water, compost, salt accumulation

Introduction

Many potato production areas in Jordan are characterized by the availability of brackish water that can be used for irrigation. The obstacle of using such water in irrigation is that the yield has been known to decrease as salinity level increases. Salinity reduces water availability in a similar manner for all types of plants; however there is a variation upon crop responses to salinity. The effect of salinity level of irrigation water depends on the potato cultivar (Zhang et al., 1993). The other obstacle of using saline water in irrigation, is the possibility that water can be a source of salts and lead to soil salinity accumulation. Potatoes are moderately sensitive to salinity compared with other crops; soil salinity level of 2 ds/m reduces the yield up to 50% (Maas and Hoffman, 1977, FAO, 1989), particularly at the early growth stages (Levy 1992, Nadler and Heuer, 1995). About 74% of the normal yield of a cultivar can be obtained under surface irrigation with water salinity levels of 2-4 ds/m (Paliwal and Yadav, 1980). According to FAO (1989), the potato yield ranges between 540 and 3300 kg/du and the salinity threshold (100% yields) for brackish irrigation water is 1.1 dS/m. The highest yield (3300kg/du) was obtained with fresh water irrigation (average EC 2.2 dS/m) followed by (3000 kg/du) which was obtained with an average water salinity of 3.8 dS/m. Bustan et al., (2004) reported that drip irrigation with saline water up to 6.2 dS/m had no significant effect on potato production in an arid environment, but the interaction between saline irrigation and prolonged heat wave events that occur during crop growth caused a decline in potato yield. The accumulation of soluble salts in the soil is directly related with the salt content of the irrigation water (Somani, 1991). Over the years, soil salinity level increased linearly with time for the soils irrigated with saline water, this case has been seen in some areas of intensive agriculture in the Jordan Valley that are becoming saline soils (JVA, 2003). The salinity problem related to water quality occurs if the total quantity of the salts in the irrigation water is high which leads to salt accumulation in the root zone. In

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areas where annual rainfall is less than 250 mm, saline water EC more than 4 dS/m will cause salt toxicity for most crops, while in areas where annual rainfall exceeds 500 mm, water salinity up to 16 dS/m can be utilized for some crops (Tesdeschi and Menenti, 2002). Potato is one of the most important vegetable crops grown in Jordan and Jordan's water availability ranks among the lowest in the world. The use of saline water in potato production could be an important strategy in sustainable agriculture in Jordan, however potatoes are very sensitive to their growth environment and not all potato cultivars are adapted to the Jordan zone and water qualities. The effect of salinity level of water depends on the potato cultivar and farmers are more interested in the cultivars producing high yields under their growth conditions without taking into cosidration the impact of acumulated salts that can lead to soil degradation.The main objective of this research is to study potato production irrigated with brackish water by minimizing slat accumulation by adding organic matter.

Materials and Methods

This experiment was conducted at the Agricultural Research Station of Al-Balqa' Applied University, Jordan during the 2014 growing season to examine the sensitivity of some local potato cultivars to saline irrigation water, to study the impact of saline water on soil quality and to investigate the impact of adding compost on salt accumulation in the soil. The brackish water was transported from a local spring in the Jordan Valley. Water was mixed with different amounts of fresh water to obtain the required water salinity levels. The three potato cultivars; Spunta, Faluka and Ambition were tested for salt sensitivity and compost use to reduce the impact of salinity. Treatments were arranged in a Randomized Complete Block Design (RCBD) with a Split- Split Plot arrangement with three replicates. The potato cultivars were arranged in the main plots, the brackish water treatments were in the sub-main and the soil amended treatments were in the sub-sub plots. Compost of EC of 0.72 dS/m and pH of 7.4 was used. The three cultivars (one tuber seed/ pot) were planted in 15 L pots with different soil and compost percentage as the following: T1 100 % Soil and 0% Compost, T2 80 % Soil and 20% Compost, T3 60 % Soil and 40% Compost, T4 40 % Soil and 60% Compost, T5 20 % Soil and 80% Compost, T6 0% Soil and 100 % Compost. All pots were drip irrigated equally with three water salinity levels: fresh water (as the control) 1.25 dS/m, 5 dS/m and 10 dS/m. Avarage root zone salinity (dS/m) was measured by preparing a 1:1 oven dried soil and distilled water (50 gm of soil mixed with 50 gm of distilled water), the electrical conductivity of the soil water solution was measured after 5 minutes by an EC meter. Tubers weight (g/pot) was determined for each cultiver under each water salinity in the three replicates. The drained water was collected and salinity was measured at weekly intervals. All statistical analyses were performed using SAS/STAT Version 9.2 and Analysis of Variance was conducted by the PROC GLIMMIX procedure.

Results and Discussion

Effect of brackish water on potato yield:

The effect of water salinity on the yields of potato cultivars was evaluated at the end of the experiment (June 2014). As presented in Table 1, the highest yield (g of tubers/pot) was recorded for Spunta cultivar. It was significantly higher than that of Ambition and Faluka. This indicates that this cultivar possesses less salinity sensitivity than the two other cultivars. In addition, the greatest yield reduction, as a result of saline water treatment, was recorded for plants that received water with salinity level 10 dS/m (Table 2 and Figure 1). The yield reduction was significant when compared to the reduction caused by other water salinity treatments. It is worth mentioning that, in contrary to Spunta and Ambition, the yield of Faluka cultivar was higher in plants that received water with salinity level 5 dS/m than those irrigated with water of EC 1.25 dS/m (Figure 1).

Table 1. Yield of three potato cultivars at the end of the experiment (June 2014).

Cultivar	**Yield per pot Mean (g)**
Spunta	298 a
Ambition	182 b
Faluka	190 b

**Means followed by the same latter are not significantly different according to LSD test at 0.05 level of probability.*

Table 2. Effect of water salinity on potato yields.

Water Salinity	**Yield per pot Mean (g)**
1.25 dS/m	294 [a]
5 dS/m	236 [a]
10 dS/m	99 [b]

**Means followed by the same latter are not significantly different according to LSD test at 0.05 level of probability.*

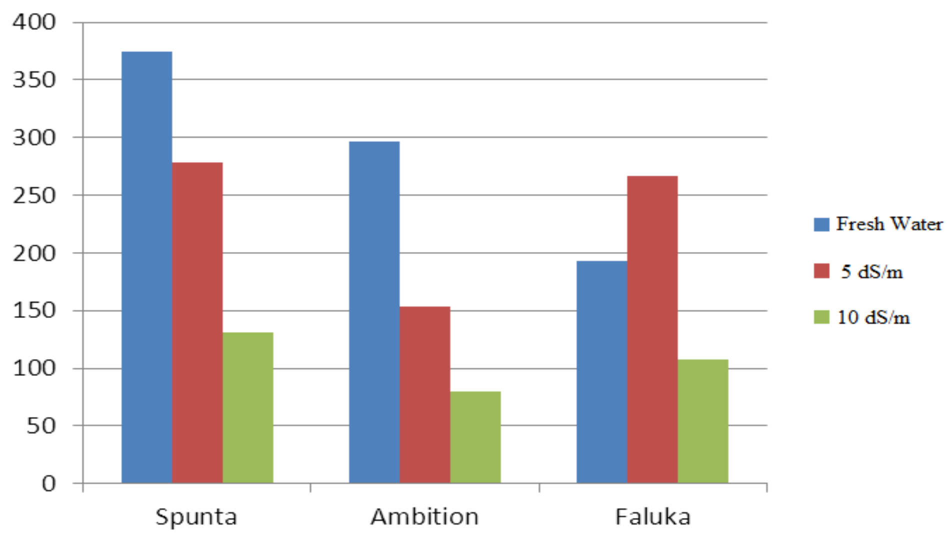

Figure 1. Effect of water salinity on the yield of three potato cultivars

Effect of compost on salt accumulation in drainage water and planting media:

Data presented in tables 3 and 4 show the effect of compost addition to the planting media on the salinity of drainage water collected from each treatment and on the accumulation of salt in the planting media. A positive correlation between compost percentage in the planting media and the salinity of drainage water was observed (Table 3). The highest drainage water salinity was recorded for treatments that had highest compost level. This clearly indicates that compost addition improves drainage, which in turn will reduce the impact of brackish irrigation water. Therefore, less salt was accumulated in the planting media with increasing the compost percentage (Table 4).

Table 3. Salinity of drainage water as affected with compost percentages collected from the three potato cultivars.

compost %	Treatment		
	1.25 dS/m	**5 dS/m**	**10 dS/m**
100 **80** **60** **40** **20** **0**	28^{a}	41^{a}	43^{a}
	26^{a}	35^{a}	37^{a}
	16^{b}	30^{a}	31^{b}
	15^{b}	21^{b}	24^{b}
	13^{b}	12^{c}	19^{c}
	4^{c}	8^{c}	11^{c}

**Means followed by the same latter are not significantly different according to LSD test at 0.05 level of probability.*

Table 4. Salinity level of planting media (at the end of the growing season).

		Salinity of irrigation water		
		1.25 dS/m	**5.0 dS/m**	**10 dS/m**
Compost %	**100**	0.3^{d}	1.1^{c}	3.5^{b}
	80	0.4^{cd}	1.25^{c}	3.5^{b}
	60	0.4^{cd}	1.25^{c}	3.7^{b}
	40	0.5^{bc}	1.4^{b}	3.6^{b}
	20	0.6^{ab}	1.7^{a}	4.1^{a}
	0	0.75^{a}	1.8^{a}	4.0^{a}

**Means followed by the same latter are not significantly different according to LSD test at 0.05 level of probability.*

The results of this study are in agreement with many studies that clearly proved the impact of soil amendments that improve vegetable growth and yield. For example, Sahrawat et al., (2009) reported that crops and cultivars within a crop differ in their sensitivity to salts and may show variable response to salt concentration in the growing medium. Moreover, they stated that compost is a common practice for growing plants in pot culture studies and that EC should be measured because it provides a simple and rapid measure of the salt concentration.

The knowledge of the threshold of the crop to salinity is very important. In their study, Cai et al., (2010) indicated that when salt content was appropriate, composted sewage sludge can be used alone as a vegetable seedling growth medium without the need for grinding or blending with other materials. In our study, brackish water, up to 5 dS/m can be used to irrigate potato specifically, if organic amendments are added to the soil to promote plant growth, yield and reduce salt accumulation.

Conclusion

Brackish water of up to 5 ds /cm can be used in production of some potato cultivers in Jordan. Although salts were accumulated in the soil as a result of using saline water in irrigation, organic matter can reduce salts accumulations and promote plant growth. Compost in the planting media can significantly reduce salt accumulation in the planting media. Based upon the results of this study, farmers are advised to add compost to the soil where potatoes will be grown to reduce the accumulation of salt in the soil. This practice will give an opportunity for farmers to cultivate their farms for longer periods when relatively saline water is used for irrigation.

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