EFFECT OF WATER QUALITY ON PRODUCTIVITY OF SOME ONION (*Allium cepa* L.) CULTIVARS, SOIL PROPERTIES AND THEIR CONTENTS OF HEAVY METALS

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ABSTRACT

Two lysimeter experiments were conducted at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, Egypt, for two seasons, 2010/2011 and 2011/2012. Lysimeters (100 x 70 x 90 cm) were filled with clayey soil and irrigated with three water treatments: twenty-five years. The present study aimed to investigate the effect of irrigation water quality for long-term on productivity of three onion cultivars: Behairy Red (CV1), Giza 20 (CV2) and Giza Red (CV3). Three irrigation water qualities: Nile water (W1), agriculture drainage water (W2) and mixed water: W3 (50% W1 + 50% W2) were used for irrigation to study its effects on onion contents from four heavy metals (Ni, Cd, Pb and Cu) and some soil characteristics. A split-plot design with four replicates was used where, water treatments and cultivars were allocated to main and sub-plots, respectively.

The obtained results showed that:

- Using poor water quality for irrigation increased ECe, SAR, soluble cations and anions in soil paste extract and DTPA-extractable heavy metals in soils (Cu, Ni, Cd and Pb) than that of mixed or good water quality.
- The maximum values of marketable yield and total bulbs yield/fed. As well as bulb quality (bulb diameter and average bulb weight) were obtained by irrigated with Nile water, while the lowest values were obtained by agriculture drainage water in 1st and 2nd seasons.
- Behairy Red cultivar produced the highly significant marketable yield and total yield, and significantly decreased culls yield as well as bulb quality (bulb diameter and average bulb weight). On the other hand, Giza 20 produced the highly significant total soluble solids (TSS%) in both seasons.
- The highest values concerning the previous characters were obtained with Behairy Red cultivar under Nile water irrigation, whereas the lowest values were obtained by Giza Red in soil irrigated with agriculture drainage water in both seasons.
- Content of the studied heavy metals were greater in bulb than in leaves.
- The results showed that Behairy Red cultivar (CV1) was more tolerant cultivar to agriculture drainage and mixed water and its contents of Ni, Pb and Cu.
- No significant differences were found between Cd content at all studied onion cultivars used for.
- The heavy metals content of onion cultivars from can be arranged as follows:
  - With Pb: CV1 < CV2 < CV3
  - With Cu: CV1 < CV2 < CV3
  - With Ni: CV2 < CV1 < CV3

Keywords: Water quality, productivity, heavy metals, onion cultivars, soil characteristics.
INTRODUCTION

Onion (*Allium cepa*, L.) is one of the most important vegetable crops grown commercially in Egypt due to its multifarious use as local consumption, processing and exportation. The cultivated area for onion production in Egypt in 2007/2008 season the area was 102,703 fed. (1 feddan = 4200 m²) and produced 1,259,007 tons with an average of 12.6 t/fed. † The average of exports reached 340,000 tons††. Increasing productivity of onion with good quality is an important target for the growers of onions. The unit of both water and area productivity still low and it is needed to be increased according to the increased people demands throughout improved agricultural practices i.e. sowing date, high-yielding cultivars, proper both fertilization and irrigation management irrigated with tannery polluted water ….etc. Optimum irrigation management is the most important factor affecting onion productivity and quality under the Egyptian conditions.

Pollution is defined as any change in physical, chemical or biological conditions of the environment which may harmfully affect the quality of human life including effects upon animals and plants. The untreated industrial drainage waters contain little or more amount of heavy metals, which may cause enhancement of their level in the Nile and/or agricultural drainage water when they mixed. A recent study showed a remarkable increase in levels of heavy metals in some Egyptian soils (especially soils lies in the extreme North Delta) in addition appreciable amount of these metals are found in vegetation, water bodies and aquatic organisms in western and Middle areas of the Nile delta (El-Sanafawy, 2002). Use of low quality water in irrigation could be an important consideration when the disposal is being planned in arid and semi arid regions. Using drainage water in irrigation caused high increase in EC and SAR of saturated soil paste extract (Omar *et al*., 2001). Meanwhile, using drainage water in irrigation significantly increase the total and DTPA extractable heavy metals compared with Nile water (Zein *et al*., 2002). Once the ions have been absorbed through the roots or leaves and have been transported to the xylem vessels there is the possibility of movement throughout the whole plants. The rate and extent of movement within plants depend on the metal concerned, the plant organ and the age of plant (Chancy and Giordano, 1977). Mn, Zn, Cd, B, Mo and Cu were classified as intermediate and Cr, Pb and Hg were translocated to least extent.

The objectives of the present work are to assess the effect of irrigation water quality for long-term on productivity, heavy metals contents (Cd, Ni, Cu and Pb) of onion cultivars and some soil characteristics irrigated with tannery polluted.

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††(General Organization for Export and Import Control)
MATERIALS AND METHODS

Two lysimeter experiments were carried out at Sakha Agricultural Research Station, Kafr El-Sheikh, Egypt, for two seasons 2010/2011 and 2011/2012 to study the effect of irrigation water quality for long–term on the productivity of three onion cultivars and the content of their, bulb and leaves of heavy metals; Pb, Cd, Ni and Cu. Eight weeks old onion seedlings of good quality were transplanting in 15th and 20th December in the first and second seasons, respectively. The experimental lay out was split plot in randomized complete block design with four replications. The studied treatments were as follows:

A- Main plots (irrigation water treatment):
   - W₁- Nile water.
   - W₂- Mixed water 50%w₁+50%w₃.
   - W₃- Agriculture drainage water.

B- Sub plot (cultivars):
   - CV₁- Behairy Red (local).
   - CV₂- Giza 20.
   - CV₃- Giza Red.

The study was conducted in concrete Lysimeters (100 x 70 x 90 cm) Filled with clayey soil since 1987. The sub plot area was 0.7 m² consisted of 4 rows each of 1 m in length and 15 cm width. Seedling within each row were spaced at 7 cm apart (containing approximately 60 seedling). All sub – experimental plots were fertilized with equal amount of calcium super phosphate (15.5%P₃O₅) at rate of 300 kg/fed. and potassium sulphate 48% K₂O) at rate of 50 kg/fed. were added during the tillage of the experiment. Amount of nitrogen, the rate of 100 kgN/fed. as ammonium nitrate, 33.5%N was applied in the two equal dose. The first dose was applied after thirty days from transplanting and the second one was added at thirty days later after transplanting.

All other cultural practices of planting onion were carried out as commonly used in this district. After 120 days from transplanting, random samples of three plants of each plot were taken for recording content of their ,bulb and leaves of heavy metals ,pb,cd ni and cu, dry aching technique was used for samples digestion as described by Chapman and Pratt (1961). Soil samples were taken from each lysimeter before planting and after harvesting, for chemical analysis; total soluble salts, soluble cations & anions in soil paste extract were determined according to Richards (1969). Soil samples were DTPA extracted and Pb, Cd, Ni and Cu were determined using an Atomic Absorption Spectrophotometer Perkin Elmer 3300. Harvesting took place around mid May when about 30%of tops were fallen down. After harvesting, roots and tops were trimmed and bulbs were classified for recording marketable bulbs yield (t/fed.), culls bulbs yield (ton/fed.),Total bulbs yield ton/fed), bulb diameter (cm) and average bulb weight (g) by dividing total yield of marketable bulbs by its number as well as total soluble solids (TSS %), which determined immediately after harvest by a hand
refractometer in the same representative sample of bulbs according to A.O.A.C. (1975).

Statistical analysis were tested by analysis of variance (little and hills, 1972). Duncan’s multiple range test was used for comparison among the treatment means Duncan’s 1965. Some characteristics of the used irrigation water are presented in Table (1). Soil chemical analysis before transplanting and after harvesting (according to Lindsay, W.K. and W.A. Norvall (1978) are presented in Table (2)

**Table (1): Chemical characteristics of Nile and agriculture drainage water used for irrigation during the two seasons.**

<table>
<thead>
<tr>
<th>Irrigation water</th>
<th>ECDS/m at 25°C</th>
<th>pH</th>
<th>Cation meq/L</th>
<th>Anion meq/L</th>
<th>SAR</th>
<th>Water class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nile water</td>
<td>0.52</td>
<td>8.00</td>
<td>1.82</td>
<td>1.49</td>
<td>1.54</td>
<td>0.35</td>
</tr>
<tr>
<td>Agriculture drainage water</td>
<td>1.82</td>
<td>8.20</td>
<td>4.10</td>
<td>2.08</td>
<td>11.41</td>
<td>0.61</td>
</tr>
<tr>
<td>Irrigation water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nile water</td>
<td>0.02</td>
<td></td>
<td>Cu</td>
<td>0.007</td>
<td>0.008</td>
<td>Ni</td>
</tr>
<tr>
<td>Agriculture drainage water</td>
<td>0.280</td>
<td>0.300</td>
<td>Cd</td>
<td>0.04</td>
<td>0.800</td>
<td>Pb</td>
</tr>
<tr>
<td>Critical limits according FAO (1989)</td>
<td>0.200</td>
<td>0.200</td>
<td>Cd</td>
<td>0.010</td>
<td>5.000</td>
<td>Pb</td>
</tr>
</tbody>
</table>

**RESULTS AND DISCUSSION**

**Nile and agriculture drainage water evaluation:**

Chemical characteristics of Nile and agriculture drainage water used for irrigation of onion cultivars are shown in Table (1) According to Richard's classification, Nile water C<sub>2</sub>-S<sub>1</sub>; medium salinity low sodicity (Richards, 1969). While, data of agriculture drainage water revealed that the water was in the class of (C<sub>3</sub>S<sub>2</sub>), high salinity and medium sodicity which can not be used for soils with restricted agriculture drainage and crop with good salt tolerance should be selected. It can be concluded that Nile water is of good quality and agriculture drainage water of poor quality for irrigation. The mixed water will be intermediate between them in relation to its chemical composition. Also data in Table (1) Showed that the studied heavy metals Cd, Pb, Ni and Cu content of agriculture drainage water were greater than of Nile water and higher than the critical limits, according to FAO (1989), i.e., 0.01, 5.00, 0.2 and 0.2 for Cd, Pb, Ni and Cu mg/L, respectively. The high heavy metal contents in agriculture drainage water could be attributed to the pollution sources of industrial and municipal wastes discharged to the agriculture drainage system these results are in agreement with these obtained by El-Mowelhi et al., (1995)and zein et al. (1998)

**Effect of the studied irrigation water qualities on some chemical properties of clay soils:**

A- Soil salinity, SAR and soluble ions:

Change in electrical conductivity of soil paste extract (dS/m) soluble cations; Ca<sup>2+</sup>, Mg <sup>2+</sup>, Na<sup>+</sup> and K<sup>+</sup> (meq/L) and soluble anions; HCO<sub>3</sub> and
SO$_4$^-; (meg/L) are listed in Table (2). Comparing the mean ECe values of the studied soils, before planting (first season) and after harvesting (second season). The data show that ECe values increased from 4.69, 5.10 and 5.60 ECe dS/m to 4.92, 6.00 and 7.68 ds/m as affected by $W_1$, $W_2$ and $W_3$ water quality treatments, respectively. SAR mean values increased from 5.34 and 6.17 to 5.94, 5.20 and 6.50 as affected by $W_1$, $W_2$ and $W_3$ water treatment. The obtained data showed also, that utilization of agriculture drainage water for irrigation purposes tend to increase soluble cations Na$^+$ and Mg$^{++}$ than before planting. The data also showed that all soluble anions, Cl$^-$ and So$_4$-$^-$ mean values, were higher in soil irrigated with poor quality in harmony with those obtained by Zein et al. (1996).

Table (2): Soil chemical analysis before planting (first season) and after harvesting (second season) under three irrigation water quality (means of two seasons)

<table>
<thead>
<tr>
<th>Water quality</th>
<th>Ca$^{++}$</th>
<th>Mg$^{++}$</th>
<th>Na$^+$</th>
<th>K$^+$</th>
<th>$CO_3$-</th>
<th>$HCO_3$-</th>
<th>Cl$^-$</th>
<th>So$_4$-</th>
<th>ECe ds/m</th>
<th>PH 1:2.5</th>
<th>SAR</th>
<th>SP%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Planting (first season)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_1$</td>
<td>17.30</td>
<td>12.00</td>
<td>17.20</td>
<td>0.40</td>
<td>2.60</td>
<td>17.10</td>
<td>27.20</td>
<td>4.69</td>
<td>8.20</td>
<td>4.49</td>
<td>75.90</td>
<td></td>
</tr>
<tr>
<td>$W_2$</td>
<td>19.63</td>
<td>12.50</td>
<td>18.30</td>
<td>0.57</td>
<td>2.70</td>
<td>16.00</td>
<td>32.30</td>
<td>5.10</td>
<td>8.25</td>
<td>4.57</td>
<td>76.80</td>
<td></td>
</tr>
<tr>
<td>$W_3$</td>
<td>21.40</td>
<td>11.50</td>
<td>12.40</td>
<td>0.54</td>
<td>3.50</td>
<td>20.20</td>
<td>32.65</td>
<td>5.60</td>
<td>8.30</td>
<td>5.53</td>
<td>78.10</td>
<td></td>
</tr>
<tr>
<td>After harvesting (second season)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_1$</td>
<td>18.25</td>
<td>12.10</td>
<td>18.30</td>
<td>0.39</td>
<td>2.70</td>
<td>16.59</td>
<td>29.40</td>
<td>4.92</td>
<td>8.15</td>
<td>4.70</td>
<td>76.40</td>
<td></td>
</tr>
<tr>
<td>$W_2$</td>
<td>20.80</td>
<td>12.45</td>
<td>19.10</td>
<td>0.42</td>
<td>2.90</td>
<td>18.23</td>
<td>32.70</td>
<td>5.20</td>
<td>8.20</td>
<td>4.68</td>
<td>77.00</td>
<td></td>
</tr>
<tr>
<td>$W_3$</td>
<td>23.40</td>
<td>13.56</td>
<td>23.85</td>
<td>0.47</td>
<td>3.60</td>
<td>21.89</td>
<td>38.60</td>
<td>6.50</td>
<td>8.25</td>
<td>5.55</td>
<td>77.30</td>
<td></td>
</tr>
</tbody>
</table>

B- DTPA- extracted heavy metals from studied soils:

Data in Table (3) show that all values of DTPA extractable heavy metals of soils can be descendingly arranged according to the effect of water treatments as follow: $W_3 > W_2 > W_1$ before onion transplanting and after harvesting.

Table (3): DTPA extractable heavy metal concentrations from 2010 to 2012 (mg/kg) before planting (first season) and after harvesting onion cultivars (means of two seasons) as affected by water quality.

<table>
<thead>
<tr>
<th>Irrigation water quality</th>
<th>Cd</th>
<th>Ni</th>
<th>Pb</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before planting (mg/kg soil)</td>
<td>0.098</td>
<td>1.60</td>
<td>4.00</td>
<td>6.00</td>
</tr>
<tr>
<td>$W_1$</td>
<td>0.156</td>
<td>2.01</td>
<td>8.90</td>
<td>6.70</td>
</tr>
<tr>
<td>$W_2$</td>
<td>0.172</td>
<td>2.70</td>
<td>11.0</td>
<td>7.52</td>
</tr>
<tr>
<td>After harvesting (mg/kg soil)</td>
<td>0.099</td>
<td>1.82</td>
<td>3.70</td>
<td>5.90</td>
</tr>
<tr>
<td>$W_1$</td>
<td>0.157</td>
<td>2.10</td>
<td>8.80</td>
<td>6.70</td>
</tr>
<tr>
<td>$W_2$</td>
<td>0.181</td>
<td>2.40</td>
<td>11.02</td>
<td>7.30</td>
</tr>
</tbody>
</table>

It seems that soil content of DTPA-extractable studied heavy metals has the following sequence Cu > Pb > Ni > Cd. This trend was different from that found under using agriculture drainage water and mixed water Pb > Cu > Ni > Cd. This may be due to that some of available Pb changed to these
findings. The obtained results are in agreement with those of Abou El-Roos et al. (1991) who found that the behaviour of Cu and Pb differ from that of Cd, Co and Ni in soils irrigated with sewage effluent, they added that in Cd, Cu and Ni metals, the percentages held in primary minerals fraction were increased with time on the expense of the percentage of other fractions, especially that organically complexed. Although the studied soils were still beyond the critical levels, it could be reached this point upon the continuous using of agriculture drainage water.

**Effect of water quality on yield and bulb quality:**

Data presented in Table 4 showed that the tested irrigation water quality exhibited significant differences in mean values of yield and yield component characters (marketable yield, culls yield, and total yield) and bulb quality (bulb diameter, average bulb weight and TSS%) in both seasons. Results indicated that, irrigated with Nile water, attained the highest mean values of marketable yield/fed. (11.46 And 10.48 t/fed.), total yield/fed. (13.69 and 12.92 t/fed.), average bulb diameter (6.76 and 6.77 cm) and average bulb weight (100.00 and 98.11 g) in the first and second seasons, respectively. On the other hand, the highest value of culls yield (2.57 and 2.46 t/fed.) and TSS% (14.10 and 14.04) was obtained by irrigation with agriculture drainage water, in the first and second seasons, respectively. From these results, it can be concluded that an increases in yield and its components as well as bulb quality due to Nile water treatment.

Significant cultivars variation was observed in all the characters (Table 4). Behairy Red (CV₁) showed maximum marketable yield, total yield, bulb diameter and average bulb weight, whereas maximum culls yield was recorded from Giza Red (CV₃). Data also showed that Giza 20 (CV₂) attained the highest means of percentage of total soluble solids (TSS %). These differences in total bulb yield/fed. may be due to genetic variation between these cultivars which affected on the efficiency of the utilization for different environmental resources. These results were in agreement with those found by Mohamed and Gamie (1999), Mohamed and Gamie (2000) and El-Damarany and Obiadalla (2005).

Regarding The interaction effect of irrigation water quality and cultivars on yield and bulb quality were significant. Moreover, Data in Table (4) and Figs.(1, 2 and 3) indicate that the maximum marketable yield and total yield was obtained from the combination of Behairy Red cultivar and irrigation with Nile water. In contrast the higher mean of culls yield (2.81 and 3.03 t/fed.) was obtained with Giza Red cultivar for agriculture drainage water in the two seasons, respectively.

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Data arranged in Table (4) and Figs. (4, 5 and 6) claimed that the maximum average of bulb diameter (cm) and weight (gm) were obtained when using Nile water in irrigation with Behairy Red (W$_1$ CV$_1$) in both seasons. The inverse was true in TSS %, While Giza 20 with agriculture drainage water gave the highest means of TSS% in the second season only (W$_3$ CV$_2$).
Heavy metals contents:

Data in Table (5) show that the studied heavy metals Cd, Pb, Ni and Cu content of onion plant under agriculture drainage water were greatest than that of Nile water and mixed water. This could be attributed to the pollution sources of industrial (oil and soap factory) and municipal wastes discharged to the agriculture drainage system. These results are in agreement with those obtained by Zein et al. (2002) and El-Mowelhi et al. (1995).

Table, 5 and Figs from, 1 to 4 illustrate the influence of water quality on the studies heavy metals means concentration in roots, coat seed, pod cover, leaves and seeds. On onion cultivars especially with irrigated by agriculture drainage water (W₃) were as the following order:

- Bulls: Pb > Ni > Cu > Cd
- Leaves: Pb > Ni > Cu > Cd

Table (5) reveals the highly significant effects of water quality (W₁, W₂ and W₃) especially with Ni, Pb.

The distribution of Cu within plants is highly variable within roots Cu is associated mainly with cell wall and its largely mobile.

Dunman et al. (1991) found that the concentration of Ni in plants, generally, reflects the concentration of the element in the soil, although the relationship is clearly more directly related to the concentration of soluble ions of Ni and rate replenishment of this mobile pool. As Ni is easily mobile in plant, berries and seeds are reported to contain elevated Ni concentration (Alina and Pendias et al., 2000).

Cadmium values (Table, 5) of seeds indicated that Cd has the lowest values in all studied heavy metals. This conclusion are in agreement with Alloway (1995) who found that the uptake of Cd decreased when pH was increased, faba bean showed a similar response.

Page et al. (1981) found that relative excess of Cu, Ni and Mn can reduce uptake of Cd by plants. The Cd in plants is relatively very
mobilize, although the translocation of Cd through the plant tissues may be restricted because Cd is easily held mainly in exchange sites of active compounds located in the cell walls (Cunningham et al., 1975).

Data in Table (5) indicates that the onion cultivars generally had the lowest content of studied heavy metals under all water treatments. No significant in Cd for all treatments of water quality and onion cultivars. V 2 variety had the lowest content of Pb, Ni and Cu under all water treatments. The order of onion cultivars to concentration of heavy metals decreased as follow:

Table (5): Effect of irrigation water treatments on heavy metals content (mg/kg) of onion cultivars (Mean of two seasons).

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Heavy metals content (mg/kg D.W)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cd</td>
</tr>
<tr>
<td>W1</td>
<td>0.1811</td>
</tr>
<tr>
<td>W2</td>
<td>0.2629</td>
</tr>
<tr>
<td>W3</td>
<td>0.2974</td>
</tr>
<tr>
<td>Leaves</td>
<td></td>
</tr>
<tr>
<td>CV1</td>
<td>0.182</td>
</tr>
<tr>
<td>CV2</td>
<td>0.217</td>
</tr>
<tr>
<td>CV3</td>
<td>1.2620</td>
</tr>
<tr>
<td>Translocation coefficient</td>
<td></td>
</tr>
<tr>
<td>CV1</td>
<td>86.18</td>
</tr>
<tr>
<td>CV2</td>
<td>82.54</td>
</tr>
<tr>
<td>CV3</td>
<td>88.10</td>
</tr>
<tr>
<td>Kabata- pendias and pendias, 1992</td>
<td>0.01</td>
</tr>
</tbody>
</table>

In comparison to standard limits of Kabata-pendias and pendias, 1992 showed that Cd, Pb and Ni (mg/Kg) were higher than that the lower limits and lower the upper limits while Cu content was lower than the upper and lower limits.

These results very important for classified the common onion cultivars to various heavy metals polluted soils. From these sequences we can favor one variety in every soil polluted with one element.

These results are in partial agreement with those obtained by Zein et al. (1996) in their study on soybean cultivars. These results may be due to the differences in genetic constitution of the studied genotypes and / or the dilution effect phenomenon. This conclusion is in partial agreement with that

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of Shalaby et al. (1996) who concluded that increasing heavy metals concentration in plants may attributed either to the higher amounts of these heavy metals added into the used soil through the applied wastes in the suffering areas. The safest policy would appear to minimize inputs of heavy metals to soil wherever to save our life and economy and restrict heavy metals bioavailability translocation coefficient from bulb to leaves:

Once the ions have been absorbed through the roots and have been transferred to the xylem vessels, there is possibility of movement throughout the whole plant, the rate and extent of movement within plants depend on the metal concerned, the plant organ and the age of plant Alloway, (1995). The data of heavy metal concentration in bulbs and leaves of studied onion cultivars and coefficient of their translocation (TC) from bulbs to leaves are presented in Table 5 and bulb to leaves TC was calculated as follows:

\[
\text{Bulb to Leaves TC} = \frac{\text{Content of heavy metal in leaves (mg/kg)}}{\text{Content of the same heavy metal in bulbs (mg/kg)}} \times 100
\]

Data in Table (5) illustrate that the studied heavy metals translocation from bulbs to leaves can be arranged according to mean values of translocation coefficient in the following decreasing order:

Cd > Ni > Cu > Pb

It shows that pb was the least in translocation from bulb to leaves in all types of water treatments (W1, W2 and W3). The results are in good agreement with those of Zein et al. (2009,2002) and Chaney and Giordano (1977) who classified pb as one of the least translocated elements with plant. They added that, under conditions of optimal growth, pb precipitates on root cell wall in the insoluble amorphous form. Zhen – Guo Shen et al. (2009) found that application of EDTA (as an organic conditioner) to the soil significantly increased the concentrations of Pb and enhancing pb accumulation in the plants while the Cu and Cd and Ni concentration and translocation coefficient indicate that Ni values increased due to agriculture drainage water treatment than other treatment due to its higher content of agriculture drainage water from oil and soap factory (used Ni catalyst in one processes of manufacturing). They also added that the result results of the sequencetial chemical extraction of soil samples showed the pb concentration in the carbonate specifically adsorbed and Fe-Mn oxide phase were significantly decrease after EDTA treatment and solubilized mainly from these two phases in the soil. Date of Table (5) illustrated that onion cultivars be haved as an accumaltor for cd, cu, ni and could be useful indicator of the metal availability for plants. The obtained results are in good agreement with (Zein et al., 2002) and Chancy and Giordano (1977) for heavy metal translocation.

Conclusion

Considering the previous discussions and conclusions, it seems that there is an obvious need for more research work to be carried out on the risk assessment of heavy metals contaminated soils. As mentioned by Essa and
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El-Kassas (1999) the danger of distribution wastes by such factories containing high concentration of heavy metals affects the survival in the suffering areas. The safest policy would appear to minimize inputs of heavy metals to soil wherever to save our life and economy and restrict heavy metals bioavailability in the soil – plant animal pathway.

Dunman et al. (1991) found that the concentration of Ni in plants, generally, reflects the concentration of the element in the soil, although the relationship is clearly more directly related to the concentration of soluble ions of Ni and rate replenishment of this mobile pool. As Ni is easily mobile in plant, berries and seeds are reported to contain elevated Ni concentration (Alina and Pendias et al., 2000).

Abo El-Naga et al. (1999) and Zien et al. (2009) recommended that attention must be earnestly given to protect the environment and commitments and the latest law issued 1994 in Egypt, must be obligatory under taken for these factories to prevent them from polluting agricultural soil by wastes.

Apart from the roles played by pollution control and soil chemistry, plant breeding can make a vital contribution through the selection and utilization of crop genotypes which accumulate the least heavy metals

REFERENCES


Cunningham, L.M.; F.W. Collins and T.C. Hutchinson (1975). Physiological and bioche


تأثیر جودة میاه الرب على إنتاجية وجودة أصناف البصل وخواص الأرض ومحیطها من العناصر الثقيلة

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أُقِیمت تجاربین بمحطة البحوث الزراعیة بالعفر، كفر الشيخ، مصر لموسمي 2010 و2011، تهدف إلى دراسة تأثیر نوعیة میاه الرب على إنتاجية وجودة أصناف البصل من الأنواع المعزولة من الاراضی، وعلى انتاجية ثلاثة أصناف من البصل في البيئة الصحیة والبدعیة، ومحاصرة وريع البصل، وذلك من خلال الدراسة الممثولة، والتي وقعت المعمایلات في قطع مشتهیة في أربع مکرات، حيث وضع الرب من القطع الرئيسية والاصصیفیة في القطع المشتیة، وتم استخداص میناء الصرف من میناء الصرف في الري، وتسمح DTPA، SAR، ECE، والمكروبات DTPA، SAR، ECE، والمكروبات، وكذلك محتوى أصناف البصل من العناصر الثقيلة، ومركز البحوث الزراعیة.

وتضمنت النتایج المبایل:

• زاد استخداص میناء الصرف في الري من قیم التوصیل الكهربائي SAR، ECE، والمكروبات DTPA، SAR، ECE، والمكروبات، وكذلك محتوى أصناف البصل من العناصر الثقيلة، ومركز البحوث الزراعیة.

• فوجد أن هناك تأثیر عالی متناسب نشوءی میناء الصرف المستخدمة في الري على المحصول ومكروبات المحتوى وكذلك محیط أصناف البصل من العناصر الثقيلة، ومركز البحوث الزراعیة.

• مکروبات معنوا میناء الصرف لكل الأصناف تحت الدراسة.

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• أوضحت النتائج أن الرمي بعياد النيل أعطت أعلى إنتاجية في أصناف البصل ومكونات المحصول ووجود الأصال في كلا الموسمين.

• أوضحت النتائج فوق الصنف البجيري الأحمر في صفات محصول الأصال القابل للتسويق للقدان والممحصول الكلي للقدان وكذلك جودة الأصال. بينما سج الصنف جيزة 20 أعلى القيم من المواد الصلبة الزائدة في كل من الموسمين.

• أدى ري الصنف البجيري الأحمر بعياد النيل للحصول على أعلى القيم من محصول الأصال القابل للتسويق للقدان والممحصول الكلي للقدان ، بينما تم الحصول على أقل القيم بري الصنف جيزة احمر بعياد الصرف في كلا الموسمين.

• كان محتوى أجزاء النبات من العناصر الثمينة تتبع المتسلسلة لبثاء الأوراق الأحمر.

• أوضحت النتائج أن البجيري أحمر كان أكثر الأصناف تحملًا لاستخدام المياه المخلوطة.

• أظهرت النتائج أن محتوى الأصناف المدرجة من العناصر الثمينة أخذ الترتيب التالي:

- بحيري أحمر أكبر من جيزة 20 أكبر من جيزة احمر لكل من الرصاص والنحاس والنيكل والكادميوم.

قام بتحكيم البحث:

كلية الزراعة - جامعة المنصورة

أ.د / السيد محمود الحديدي

مركز البحوث الزراعية

أ.د / فاوق إبراهيم زين
Table (4): Total bulbs yield and Bulb quality of three onion cultivars as affected by different irrigation water treatments and their interaction in 2010/2011 and 2011/2012 seasons.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Season</th>
<th>2010/2011</th>
<th>2011/2012</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total bulbs yield</td>
<td>Bulb quality</td>
<td>Total bulbs yield</td>
</tr>
<tr>
<td></td>
<td>2010/2012 (t/fed.)</td>
<td>Bulb diam (cm)</td>
<td>TSS (%)</td>
</tr>
<tr>
<td>Irrigation water (I):</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>W1: Nile water.</td>
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<tr>
<td>W2: Mixed water 50% W1 + 50% W3</td>
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<td></td>
<td></td>
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<tr>
<td>W3: Agriculture drainage water.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>interaction (I x CV):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onion cultivars (CV):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV1 - Behairy Red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV2 - Giza 20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV3 - Giza Red</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culls yield (t/fed.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketable yield (t/fed.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culls yield (t/fed.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulb diameter (cm)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* * * and NS indicate P<0.05, P<0.01 and not significant, respectively. Means in the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan’s multiple range test.