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Effect of Irrigation with Sanitary Water on Growth and Quality of *Chrysophyllum oliviforme* L., Plant

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Abstract: A study was conducted during 2021 and 2022 seasons at Tropical Farm of Kom Ombo district, Aswan to find out the response of Satinleaf (*Chrysophyllum oliviforme* L.) 6-month-old seedlings to irrigation with primary-treated sanitary water; alone or in mixtures with fresh water at 1:2, 1: 1 and 2:1 (v/v) in a complete randomized design experiment. The obtained results indicated that the mean values of various vegetative and root growth parameters were significantly improved by irrigation with the different water mixtures used in this study compared to the control treatment (irrigation with fresh water), with the superiority of water mixture (1:1), which attained the highest mean values over the means of control and all the other water mixtures in the two seasons. The least growth means, however were recorded in plants irrigation with crude sanitary water (100 %), with few exceptions in both seasons. The percentages of pollution resistance index (PRI %) were increased, even by 100 % sanitary water treatment with significant differences relative to control one. A similar trend to that of growth measurements was also obtained the regarding concentrations of chlorophyll a, b, carotenoids, total soluble sugars, N, P, K and Ca in the leaves, while the concentrations of Na, Cl, Mg, Fe, Cu, Mn, Pb, Ni, Cd and Co were gradually increased as the proportion of sanitary water was increased in the used water mixtures to reach the maximum with 100 % sanitary water treatment. Accordingly, it can be proposed to use primary-treated sanitary water for irrigation of *Chrysophyllum oliviforme* L. plants after mixing it with fresh water at equal volumetric parts for each (1:1, v/v) to get the best growth and highest plant quality.

Key words: Satinleaf (*Chrysophyllum oliviforme* L.) · Sanitary water · Water quality · Vegetative and root growth · Pollution resistance index (PRI)

INTRODUCTION

Chrysophyllum oliviforme L. (Fam. Sapotaceae), known as the Satinleaf (due to the distinctive colour of its leaves), it is a medium-sized tree reach up to 10 m tall, native to Florida, Bahamas and Belize. Commonly used as an ornamental in yards, side walks and public gardens. The wood of the tree is hard and used in constructions [1]. This species has one trunk which can be around 30 cm in diameter. The bark is thin, gray-brown with many fissures and plates. The branches slightly droop at tree maturity. The leaves are evergreen, alternate, simple with pinnate venation, ovate and range in length from 3 to 11 cm and in breadth from 2 to 5 cm. The top of the leaf is dark green, while the bottom ones are light brown or copper, giving the tree a very aesthetically pleasing feature. The inflorescence is fasciculate and the flowers are small and creamy yellow in colour. The ripe fruits are dark purple and have a gum-like skin, so they are edible and viable for chewing and propagation [2].

At present, Egypt suffers from a severs water deficiency due to the constant its share of the Nile water that has not change since 1959 (55.5 milliard m^3), the over population, the increasing of industrial and urban activities and lately the crisis of the Grand Ethiopian Renaissance Dam (GERD). So, it is urgent to find out another water sustainable resource to face such dilemma. Among these resources may be using the treated wastewater. In this regard, Albdaiwi *et al*., [3] mentioned that the Middle region East is one of the most dry regions in the world that obligatory needs to use of municipal-treated wastewater for crop irrigation. Perulli *et al*., [4] stated that using of secondary treated wastewater for planting purposes may be one of the actual strategies to

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raise crop production during hot (drought) seasons although such type of water may cause some environmental and health risks. This truth was also documented by Hassan and Tippner [5] on neem, Seres *et al*., [6] on willow and Ahmali *et al*., [7] on olive.

Till now, the literature cited lacks studies about the effects of either sanitary or treated wastewater on growth and chemical composition of *Chrysophyllum* species, while many reports were obtained on other plant species by Shahin and Boraas [8] on *Dodonaea viscosa*, Shahin and El-Malt [9] on *Acacia nilotica*, *Quercus ruber* and *Tipuana tipu*, Abdalla [10] on *Strelitzia reginae* and *Dianthus caryophyllus*, Tawila *et al*., [11] on neem, Shahin and Tawila [12] on *Casuarina equisetifolia* and *Eucalyptus restrata*, Aman *et al*., [13] on *Robinia pseudoacacia*, *Cercis siliquastrum* and *Caesalpinia gilliesii*, Shahin and Basher [14] on *Khaya senegalensis* and *K. ivorensis*, Jerbi *et al*., [15] declared that primary effluent wastewater increased leaf area and leaf N and chlorophyll a + b contents in *Salix miyabeana* trees. They added that, stomatal sizes and stomatal pore index were higher in trees irrigated with wastewater and that increased stomatal conductance which finally led to increases in dry biomass.

Similar observations were also obtained on fruit crops by Ahmali *et al*., [7] on olive, Nemera *et al*., [16] on avocado, Perulli *et al*., [4] on apple and nectarine and Albdaiwi *et al*., [3] who found that the continuous irrigation of lemon trees grown in arid area with municipal-treated wastewater raised, the accumulation of nutrients and heavy metals (HMs) in the soil and plant parts, both alike compared to fresh water irrigation. However, HMs accumulation in the soil was in the acceptable range of WHO standards, while in the fruits, accumulation of such metals (especially Cd and Pb) exceeded the maximum levels, so the fruits were markedly affected.

The present work however was done to reveal the response of Satinleaf seedlings to irrigation with primary-treated sanitary water mixed with Nile (fresh) water at the different levels for each.

MATERIALS AND METHODS

This experiment was carried out at the Tropical Farm of Kom Ombo district, Aswan Governorate, Upper Egypt in a semi-shaded open place of the Farm during the two consecutive seasons of 2021 and 2022 to study the effect of irrigation with sanitary water combined with fresh Nile water at various levels on growth and chemical composition of *Chrysophyllum oliviforme* L. plants.

Therefore, uniform (6-month-old) seedlings at a length of about 21-22 cm were transplanted on March, 1st for every seasons into 30-cm-diameter black polyethylene bags with bottom drainage holes (one seedling/bag) filled with about 10 kg of a sandy loam soil. The physical and chemical properties of the soil used in the two seasons are shown in Table (1).

Immediately after planting, the seedlings were irrigated day after day during the course of this study with the following water quality treatments:

- Fresh water (ECW 0.23 dS/m) as control.
- Mixtures of fresh and primary treated sanitary water (obtained from Palana Wastewater Treatment Plant, Kom Ombo, Aswan) at different volumetric ratios as follows:
  - Fresh water + primary-treated sanitary water (2:1, v/v).
  - Fresh water + primary-treated sanitary water (1:1, v/v).
  - Fresh water + primary-treated sanitary water (1:2, v/v).

Primary-treated Sanitary Water (100 %): The chemical and pathological characteristics of the used sanitary water were determined and listed in Tables (2) and (3), respectively.

The layout of the experiment in the two seasons was a completely randomized design, replicated thrice and each replicate contained three seedlings Mead *et al*., [17]. Furthermore, all seedlings under the different irrigation treatments received the usual agricultural practices whenever required, except of fertilization.

At the end of each season (October, 30th), the following data were recorded: plant height (cm), stem diameter at the base (cm), number of leaves/plant, leaf area (cm^2), the longest root length (cm), as well as fresh and dry weights (g) of stem, leaves and roots. The pollution resistance index as a percentage (PRI %) was then, calculated from the equation revealed by Wu and Huff [18] as follows:

$$PRI (\%) = \text{Mean root length of the treated plant / mean root length of control plant} \times 100$$

In fresh leaf samples taken from the middle parts of the plants, photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g. f. w.) and the percentage of total soluble sugars were determined according to the methods of Sumanta *et al*., [19] and Dubois *et al*., [20], respectively, while in dry ones, the percentages of

Table 1: The physical and chemical properties of the soil used

Particle size distribution (%)								Cations (meq/L)				Anions (meq/L)						
Coarse sand	Fine sand	Silt	Clay	S.P. (%)	E.C. (dS/m)	pH	SAR	Ca^{++}	Mg^{++}	K^{+}	Na^{+}	HCO_3^-	Cl^-	SO_4^{--}	O.M. (%)	N^{+3} (total) (%)	P^{+3} (av.) (ppm)	K^{+} (av.) (ppm)
74.46	6.39	6.70	12.45	25.98	4.81	8.03	8.07	24.12	13.21	1.73	34.22	3.61	25.33	44.34	1.10	0.20	3.50	97.50

Table 2: Chemical analysis of primary-treated sanitary water used in both seasons.

				Macro-elements (%)							Macro and heavy metals (ppm)						
Season	E.C. (ppm)	Ph	SAR	N	P	K	Ca	Mg	Na	Cl	Zn	Fe	Mn	Cu	Pb	Cd	Ni
2021	2000	7.8	8.3	4.1	0.27	1.23	1.10	0.41	0.45	0.32	642	400	450	610	40.0	10.0	100.0
2022	2046	8.0	7.9	4.0	0.31	1.26	1.00	0.44	0.41	0.33	629	410	500	600	41.9	8.9	97.3

SAR: Sodium adsorption ratio.

Table 3: Detection of pathogenic indicators, salmonella & shigella and human parasites in sanitary water sample in both seasons.

	Detection			Human parasites	
Pathogenic indicators	2021	2022	Detection	2021	2022
Total coliform bacteria	d	d	*E. histylotica* Cyst.	d	d
Fecal coliform bacteria	d	d	*G. lamblea*	d	nd
Salmonella & shigella	d	d	*E. coli*, Raund-and Hook worms	d	d

d: detected, nd : non detected, *E. Emobiae* and *G.: Giardia*.

nitrogen, phosphorus and potassium Chapman and Pratt, [21], calcium and magnesium Dewis and Freitas, [22], as well as sodium and chloride Jackson, [23] were measured. Moreover, dry leaf samples were ashed in a muffle furnace at 600 °C for 6 hrs. to evaluate the concentrations of ferrous (Fe), manganese (Mn), lead (Pb), nickel (Ni), cadmium (Cd) and cobalt (Co) as ppm using the methods described by Cottenie *et al*., [24].

Data were then tabulated and subjected to analysis of variance using the Assistant Software Program of Silva and Azevedo [25], which followed by Duncan`s New Multiple Range Test Steel and Torrie, [26] for means comparison of the different treatments.

RESULTS AND DISCUSSION

Effect of Water Quality Treatments On Vegetative and Root Growth Parameters: From data averaged in Tables (4 and 5), it can be concluded that mean values of the different vegetative and root growth traits were significantly increased by irrigating with water mixtures of fresh and primary-treated sanitary water at any ratio as compared to control (fresh water) treatment in the two studied seasons, with the superiority of 1:1 water mixture, which gave the highest mean values over control and all other water treatments in both seasons. The least records were however attained by irrigating with 100 % sanitary water that reduced means of various growth parameters to the minimum values, with few exceptions in the first and second seasons. These exceptions included the significant improvement in means of root length (cm) and roots fresh and dry weights (g) which were statistically at par with the means recorded by the water mixture at a ratio of 2:1 in most cases of the two seasons. Another exception is the significant reduction caused by FW + SW (1:2) water treatment that acquired mean values closely near to those of 100 % sanitary water treatment in both seasons.

Pollution Resistance Index (PRI %): The percent of pollution resistance index is considered one of the real indicators for tolerance of plants to abiotic stresses. However, unexpected result was obtained from calculating this index for Chrysophyllum plants as shown in Table (6), where the percentages of such indicator were higher than 100 % of control mean, even by irrigation with 100 % sanitary water treatment which raised the mean values of PRI to more than 108 % in the first and second seasons. This of course, attributed to the increment in root lengths by all water quality treatments applied in the two seasons, especially by FW + SW (1:1) water treatment that scored the longest roots in the two seasons, consequently resulted gave the highest percentages of PRindices. Elongating root length of plants under stress conditions improved their tolerance for such stress.

Chemical Composition of the Leaves: It is obvious from data presented in Table (6) that concentrations of chlorophyll a, b and carotenoids (mg/g f.w.) and the percent of total soluble sugars were increased by only irrigating with fresh and sanitary water mixtures at any proportion, with the dominance of 1:1 (v/v) water mixture that increased the concentrations of the previous constituents to the utmost high means in the two

Table 4: Effect of irrigation water quality on some growth traits of *Chrysophyllum oliviforme* L. plants during 2021 and 2022 seasons.

	Plant height (cm)		Stem diameter (cm)		No. leaves/plant		Leaf area (cm^2)		Root length (cm)	
Water quality	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Fresh water (FW)	37.40d	38.70d	0.65b	0.70b	17.50d	18.00d	36.40c	39.30c	25.50d	27.30d
FW + SW (2:1)	42.00c	42.80c	0.85a	0.88a	19.70c	20.50c	38.90b	42.00b	28.70c	30.50c
FW + SW (1:1)	47.30a	48.60a	0.93a	0.96a	23.00a	24.1a	46.70a	50.30a	33.50a	35.00a
FW + SW (1:2)	45.50b	46.70b	0.47c	0.50c	21.50b	22.00b	47.00a	50.00a	31.40b	33.10b
Sanitary water (SW)	30.10e	30.50e	0.43c	0.45c	12.60e	12.50e	32.00d	34.60d	27.60c	29.50c

There is no significant difference among means have the same letter in the same column (DNMRT)

Table 5: Effect of irrigation water quality on stem, leaves and roots fresh and dry weights of *Chrysophyllum oliviforme* L. plants during 2021 and 2022 seasons.

	Stem fresh weight (g)		Stem dry weight (g)		Leaves fresh weight (g)		Leaves dry weight (g)		Roots fresh weight (g)		Roots dry weight (g)	
Water quality	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Fresh water (FW)	11.50d	11.90d	4.90d	5.00d	9.50d	10.00d	4.60d	4.80d	5.70d	6.10d	2.50d	2.70d
FW + SW (2:1)	13.60c	14.00c	5.80c	6.00c	11.60c	11.90c	5.50c	5.70c	6.50c	6.90c	2.80c	3.10c
FW + SW (1:1)	16.50a	17.10a	7.90a	8.30a	13.90a	14.30a	6.70a	7.40a	8.00a	8.10a	3.90a	4.00a
FW + SW (1:2)	15.30b	15.90b	6.20b	6.50b	13.00b	13.10b	6.00b	6.30b	7.30b	7.50b	3.50b	3.70b
Sanitary water (SW)	8.70e	9.40e	3.50e	3.70e	6.90e	7.20e	3.00e	3.10e	6.20c	6.30d	2.70c	2.80d

There is no significant difference among means have the same letter in the same column (DNMRT)

Table 6: Effect of irrigation water quality on pollution resistance index, pigments and total soluble sugars concentrations in the leaves of *Chrysophyllum oliviforme* L. plants during 2021 and 2022 seasons

	PRI (%)		Chlorophyll a (mg/g.f.w.)		Chlorophyll b (mg/g.f.w.)		Carotenoids (mg/g f.w.)		Total soluble sugars (% d.w.)	
Water quality	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Fresh water (FW)	100.00e	100.00e	2.10	2.33	0.75	0.73	0.95	1.01	1.48	1.50
FW + SW (2:1)	112.55c	111.72c	3.00	3.10	0.87	0.81	1.07	1.10	1.96	1.95
FW + SW (1:1)	131.37a	128.21a	4.08	4.00	0.96	0.98	1.23	1.32	2.35	2.36
FW + SW (1:2)	123.14b	121.25b	3.76	3.90	0.89	0.88	1.10	1.14	2.21	2.18
Sanitary water (SW)	108.24d	108.06d	1.86	1.93	0.68	0.65	0.76	0.87	1.23	1.21

Table 7: Effect of irrigation water quality on nitrogen, phosphorus, potassium, calcium and magnesium concentrations in the leaves of *Chrysophyllum oliviforme* L. plants during 2021 and 2022 seasons

	N (%)		P (%)		K (%)		Ca (%)		Mg (%)	
Water quality	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Fresh water (FW)	1.83	1.74	0.11	0.13	1.06	1.10	2.00	1.93	0.48	0.52
FW + SW (2:1)	1.97	1.98	0.14	0.17	1.25	1.21	2.14	2.16	0.55	0.59
FW + SW (1:1)	2.30	2.19	0.20	0.25	1.38	1.43	2.46	2.50	0.68	0.67
FW + SW (1:2)	1.98	2.01	0.20	0.23	1.31	1.28	2.17	2.20	0.89	0.93
Sanitary water (SW)	1.55	1.63	0.06	0.09	0.89	0.91	1.88	1.95	1.05	1.10

Table 8: Effect of irrigation water quality on sodium, chloride, iron, cupper and manganese concentrations in the leaves of *Chrysophyllum oliviforme* L. plants during 2021 and 2022 seasons.

	Na (%)		Cl (%)		Fe (ppm)		Cu (ppm)		Mn (ppm)	
Water quality	2021	2022	2021	2022	2021	2022	2021	2022	2021	2022
Fresh water (FW)	0.071	0.076	0.110	0.131	58.0	68.5	1.99	2.10	45.50	50.20
FW + SW (2:1)	0.183	0.171	0.201	0.260	105.0	113.0	23.50	27.00	85.00	83.90
FW + SW (1:1)	0.256	0.280	0.303	0.341	139.3	146.6	35.70	36.50	143.10	146.50
FW + SW (1:2)	0.395	0.363	0.410	0.396	156.5	163.8	40.80	42.00	186.80	189.70
Sanitary water (SW)	0.510	0.558	0.563	0.538	189.7	190.5	45.30	46.30	243.40	246.00

Table 9: Effect of irrigation water quality on lead, nickel, cadmium and cobalt concentrations in the leaves of *Chrysophyllum oliviforme* L. plants during 2021 and 2022 seasons

	Pb (ppm)		Ni (ppm)		Cd (ppm)		Co (ppm)	
Water quality	2021	2022	2021	2022	2021	2022	2021	2022
Fresh water (FW)	4.91	5.03	0.81	1.00	0.53	0.61	0.91	1.03
FW + SW (2:1)	17.50	18.10	10.50	9.38	1.80	1.95	6.20	6.36
FW + SW (1:1)	27.83	28.00	15.66	16.10	4.51	5.10	10.48	9.73
FW + SW (1:2)	33.61	33.97	18.70	19.23	10.33	11.50	12.63	13.06
Sanitary water (SW)	60.15	58.33	21.31	20.90	13.56	14.15	16.71	17.61

seasons. The least records were however achieved by using sanitary water (100 %) for irrigation. A similar trend was also obtained regarding the concentrations of nitrogen, phosphorus, potassium and calcium as percentages in both seasons (Table, 7).

On the other hand, the percentages of magnesium, sodium and chloride, as well as concentrations of iron, cupper, manganese, lead, nickel, cadmium and cobalt as ppm (Tables, 7-9) were progressively increased with increasing the proportion of sanitary water in the mixtures of water employed in this study to reach the maximum by concentration irrigating with % sanitary water that gave the highest concentrations relative to those of control and other water mixtures used in the two seasons.

DISCUSSION

The positive effect of mixed sanitary water with fresh one at low (25 %), medium (50 %) and even 75 % proportions may be attributed to the presence of organic matter and some essential nutrients, such as N, P, K, Ca, Mg, Fe, Mn and Zn (as shown in Table, 2), which are necessary for healthy growth and good quality of the plants, beside its role in improving fertility, cation exchange capacity and physical and chemical properties of the soil. In this regard, Seres *et al*., [6] observed that growth and biomass yield of willow (*Salix viminalis*) were significantly improved by irrigating with treated wastewater. Likewise, Jerbi *et al*., [15] noticed that irrigating *Salix miyabeana* trees with municipal wastewater increased leaf area, leaf nitrogen and chlorophyll a and b contents and stomatal size and pore index were higher in wastewater irrigated trees, resulting in an increase of stomatal conductance and this finally led to increases in biomass yields. On neem plant (*Azadirachta indica*), Hassan and Tippner, [5] reported that exploitation of treated wastewater in irrigation of this tree species which has similar properties to traditional tone wood species can play an important role in the future for the musical instrument industry.

Similar observations were also obtained by Shahin and El-Malt [9] on sant, oak and tipu trees, Abdalla [10] on bird-of-paradise and carnation, Singh and Srivastava [27] on *Eucalyptus hybrid*, *Populus deltoides*, *Salix alba* and *Melia azedarach* timber species, Shahin and Tawila, [12] on *Casuarina equisetifolia* and *Eucalyptus rostrata* and Shahin and Basher [14] who revealed that irrigation of *Khaya senegalensis* and *K. ivorensis* woody trees with a mixture of fresh and sanitary water at either 2: 1 or 1: 1 ratios improved growth and nutritional status with various significant differences. In addition, Ahmali *et al*., [7] postulated that irrigating olive grove with olive mill wastewater + urban wastewater for a period more than one year gave statistically significant increases in plant height, trunk diameter, stomatal conductance, No. fruits and oil yield.

On the other side, the negative effects of using sanitary water without dilution may be ascribed to the accumulation of some toxic metals, especially Pb, Cd and Ni at high concentrations (as shown in Table, 2) and presence of some salt ions, mainly Na^+ and Cl^- which may cause ion imbalances and toxicity in the plant cells, chlorosis, stunting, leaves fall, decreasing of biosynthesis and cell division processes, besides some other physiological disorders [10]. Furthermore, sanitary water may increase soil pH, reduce water uptake and availability of nutrients Shahin and Basher, [14]. In this respect, Nemera *et al*., [16] pointed out that irrigation with treated wastewater (TWW) and blended TWW + fresh water at a 1:1 (v/v) ratio negatively affected stomatal conductance, leaf CO_2 assimilation rate and growth of "Hass" avocado (*Peresea americana*) orchard. Similarly, Albdaiwi *et al*., [3] noticed that the continuous irrigation of lemon trees with municipal treated- wastewater led to growth reduction and more accumulation of HMs (Cd and Pb) in plant parts (included fruits) as compared to fresh water irrigation. Heavy metal accumulation coincided with high translocation rates to different parts of the tree and this is a main challenge for long-term irrigation with TWW in arid environments.

Another disadvantage of sanitary water use is its risks for environment and health. It is a potential source for toxic metals (e.g. Cd, Pb and Ni) and human parasites (e.g. *Salomnella* & *Shigella*, *Escherichia coli* and *ascaris ova* as shown in Table, 3). In this concern, Aman *et al*., [13] observed that *Robinia pseudoacacia* and *Cercis siliquastrum* had the highest Pb concentrations (15 and 32 ppm) in their shoots irrigation with either 100 or 50 % of industrial wastewater. Perulli *et al*., [4] declared that the total bacterial count on shoots of apple and nectarine trees was double in secondary wastewater-treated plants relative to tap water-irrigated ones. No. *E. coli* was found in shoot and fruit, few coliforms were detected in shoot tissues and in nectarine fruits, far below European microbiological limits for foodstuff. On lemon tree, Albdaiwi *et al*., [3] stated that the continuous irrigation with secondary treated-wastewater raised Cd and Pb concentrations, which exceeded the maximum limits for the in presence in plant tissues.

The means of critical upper levels of Cu, Mn, Pb, Ni, Cd and Co in plant tissues range between 30-35, 1000-1200, 34-40, 130-220, 30-35 and 20-40 ppm, respectively as reported by Macnicol and Beckett [28]. However, data averaged in Tables (8 and 9) exhibit that Mn, Ni, Cd and Co concentrations in chrysophyllum leaf tissues were lower than aforenamed critical levels of these metals, whereas the concentration of Cu slightly surpassed such limit by irrigation with either mixed water, especially at 1:1 and 1:2 ratios or crude sanitary water treatments. Also, Pb concentration exceeded the critical level by only crude sanitary water irrigation. Lead is a highly toxic element acts as mutagenic agent deranges the spindle fiber mechanism of cell division in both plant and human cells Bryce-Smith, [29]. Excess Cu induces severe chlorosis for plants grown in sandy soil low in Fe concentration. It also causes an actual Fe deficiency by inhibiting translocation of Fe from roots to aerial parts. Copper phytotoxicity greatly influences root development and metabolism, consequently growth can be reduced [30]. These findings could be supported by those decided by Tawila *et al*., [11] on *Azadirachta indica*, Aman *et al*., [13] on *Robinia pseudoacacia*, *Cercis siliquastrum* and *Caesalpinia gilliesii* and Shahin and Basher [14] who stated that increasing the percent of sanitary water in the mixture of irrigation water from 25 to 50, 75 and 100 % caused a gradual increment in Fe, Cu, Mn, Pb, Cd, Co and Ni concentrations in the leaves of both *Khaya* species: *K. senegalensis* and *K. ivorensis* seedlings.

From the previous results, it can be recommended to irrigate *Chrysophyllum oliviforme* L plants with fresh + sanitary water mixture at equal volumetric parts (1: 1, v/v) to exploit this wastewater resource in production of such woody tree with good growth and high quality.

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