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REDUCING THE HARMFUL EFFECTS OF SANITARY WATER ON GROWTH AND QUALITY OF SOME ECONOMIC TREES USING JASMINE OIL

S.M. Shahin and A.S. Tawila

Botanical Gardens Res. Dept., Hort. Res. Inst., ARC, Giza, Egypt.

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Prof. Dr. Eman M. Abou El-Ghait, Banha Univ.

Prof. Dr. M.M. Farahat, Agric. & Biol. Res. Div., NRC.

ABSTRACT: An experiment was undertaken in the open field at the nursery of Hort. Res. Inst., ARC, Giza, Egypt during 2013 and 2014 seasons to explore the effect of different water qualities (fresh, mixed (50% fresh + 50% sanitary water) and primary treated sanitary water), various concentrations of jasmine oil (0.0, 0.03 and 0.05%) applied as foliar spray, 3 times with 15 days interval and their interactions on growth and chemical composition of one-year-old seedlings of Australian pine (*Casuarina equisetifolia* L.) and River Red Gum (*Eucalyptus rostrata* Schlecht.) cultivated in 16-cm-diameter black polyethylene bags filled with about 3.5 kg of clayey soil.

The obtained results have shown that all vegetative and root growth parameters of the used two trees were significantly increased in response to the different sole treatments and interactions used in this study. A similar trend was also obtained concerning the leaf content of chlorophyll a, b and carotenoids, as well as total soluble sugars, N, P and K in the stem, leaves and roots, as they were markedly increased by the various employed treatments. On the other hand, content of Pb and Cd in the stem, leaves and roots was increased as the level of sanitary water increased in irrigation water, but they were gradually decreased with increasing jasmine oil concentration in spray solution. In general, content of these two metals in various plant organs was greatly less than their critical levels that induce toxicity. So, no morpho-or physio-logical disorders appear on the plants of the two studied tree species. However, the prevalence in all previous measurements was for the combining between irrigation with mixed water and spraying with 0.05% jasmine oil solution, as this combination gave the best rate of vegetative and root growth and the highest content of pigments, total soluble sugars, N, P and K in plant tissues accompanied with the least content of Pb and Cd elements.

Hence, it could be said that primary treated sanitary water can be used after mixing with fresh water at equal parts in irrigation *Casuarina equisetifolia* L. and *Eucalyptus rostrata* Schlecht. plants proved spraying them with 0.05% jasmine oil solution, 3 times with 15 days interval to achieve the best growth and highest quality.

Key words: *Casuarina equisetifolia* L., *Eucalyptus rostrata* Schlecht., sanitary water, jasmine oil, vegetative and root growth, chemical composition, water quality.

INTRODUCTION

Casuarina equisetifolia L., Australian pine (Fam. Casuarinacae) and *Eucalyptus rostrata* Schlecht., River Red Gum (Fam. Myrtaceae), both are native to Australia, cultivated on canals, agricultural roads, avenues and belts. They are also grown for shading, erosion prevention and for wind breaking. Their wood is used for fuel and charcoal, as well as for wood industry (Bailey, 1976 and Huxley *et al*., 1992).

Although reuse of sanitary water for irrigation proved to have some disadvantages on some plants, it has some beneficial effects on other ones, especially economic ornamentals which are not food chain crops. In this respect, Verma *et al*. (1991) found that irrigation with municipal effluent caused significant increases in height, girth, branch and leaf number, and in dry matter production of *Eucalyptus tereticornis* and *Lucaena leucocephala*. Likewise, were the results of Kanekar *et al*. (1993) on *Acacia nilotica* and *Casuarina equisetifolia*, Poraas (2000) on *Eucalyptus batryoides* and *Casuarina tenussima*, Abbas (2002) on *Casuarina glauca*, *Populus nigra* and *Taxodium distichum* and Hassan (2005) who revealed that primary treated sewage water significantly increased plant height, stem diameter, leaves and branches No., leaf area and fresh dry weights of leaves, shoots and roots of *Khaya senegalensis*, *Swiettenia mahogony* and *Taxodium distichum*. Specific gravity and fiber length took the same trend of vegetative growth in the 3 timber species. This water also gave the significantly high values of total chlorophyll content, N, P, K, Na, Cu, Mn, Zn, Cd, Ni, Pb and Fe concentrations in the different plant parts of the 3 trees. Other benefits were also recorded by Gogate *et al*. (1995) on teak (*Tectona grandis*), Shahin and Poraas (2005) on *Dodonaea viscosa*, Shahin and El-Malt (2006) on *Acacia nilotica*, *Quercus suber* and *Tipuana Tipu*, Abdalla (2007) on bird-of-paradise and carnation and Odindo *et al*. (2013) on *Phaseolus vulgaris* and *Beta vulgaris*.

It is well known that jasmonates are important signaling molecules for plant defensive responses upon mechanical wounding, herbivory damage or fungal inoculation. This was emphasized by Naidoo *et al*. (2013) on *Eucalyptus grandis*, Moreira *et al*. (2012) on *Pinus pinaster*, Semiz *et al*. (2012) on *Pinus sylvestris* and *Quercus ilex*, Boeckler *et al*. (2013) on *Populus nigra* and Lombardero *et al*. (2013) on *Pinus pinaster* and *P. radiata*. Furthermore, Kondo (2010) mentioned that jasmonates are able to regulate ethylene biosynthesis and aroma volatiles in the skin of apples and pears, and increased ester and alcohol production in fruits. Jasmonates have a role in plant defense against environmental stress, where the application of N-propyl dihydrojasmonates (PDJ), a jasmonic acid (JA) derivative, decreased low–temperature injuries such as splitting and spotting in apple fruits. PDJ application also induced stomatal closure in citrus leaves. Likewise, Gonzalez-Aguilar *et al*. (2003) stated that methyl jasmonate (MeJA) application reduced chilling injuries in *Carica papaya*.

Another physiological effects were also observed by Nojiri *et al*. (1992) who postulated that jasmonates promoted bulb formation and development in onion and Koda *et al*. (1998) who revealed that jasmonates stimulated potato tuberization. Moreover, Tamari *et al*. (1995) claimed that jasmonates induced the pigmentation and flavonoid gave expression in *Petunia hybrida* corollas. Kondo and Yazama (2004) reported that JA stimulated callus formation on apple pulp discs and promoted anthocyanin accumulation in apple fruit skin. Kondo (2010) affirmed that PDJ application increased fruit coloration in apples.

Other results indicated that dipping of carnation cut-flowers in jasmine oil at 0.03% enhanced flower quality and prolonged vase life by improving water uptake, reducing depletion of sugars content and pigments in the leaves (Zaky and El-Zayat, 2008). Ahmed *et al*. (2010) noticed that spraying jasmine oil solution at 0.03% concentration on foliage of *Phoenix canariensis* and *Latania lontaroides* palms gave better growth and higher content of chlorophyll a, b, carotenoids, total carbohydrates and indoles than NPK mixture at 2.5 g/pot. These observations were supported by results of Zabala *et al*. (2010) on *Thevetia peruviana*, Lovatt and Zheng (2010) on *Pistacia vera*, Shafiq *et al*. (2011) on "Cripps Pink" apple, Moreira *et al*. (2012) on *Pinus pinaster*, Gong *et al*. (2012) on *Ziziphus jujupe*, Shafiq *et al*. (2013) on "Cripps Pink" apple, Ozturk *et al*. (2013) on "Fuji" apples and Sunil *et al*. (2014) on loquat (*Eriobotrya japonica*).

The present work, however aims to reveal the role of jasmine oil in improving growth and quality plus enhancing tolerance ability of *Casuarina* and *Eucalyptus* trees to hazards of sanitary water when use at various strengths for irrigation.

MATERIALS AND METHODS

A trial was carried out in the open field at the nursery of Hort. Res. Inst. ARC, Giza, Egypt throughout the two consecutive seasons of 2013 and 2014 to study the effect of irrigation with sanitary water, foliar spray with jasmine oil and their interactions on growth performance and chemical composition of Australian Pine and River Red Gun seedlings.

Thus, homogenous one-year-old seedlings of both *Casuarina equisetifolia* L. and *Eucalyptus rostrata* Schlecht. of about 35 cm length were planted on April, 1st for each season in 16-cm-diameter black polyethylene bags filled with about 3.5 kg of clayey soil. Some physical and chemical properties of the clay used in the two seasons were determined and illustrated in Table (1).

The seedlings were irrigated immediately after planting with 1500 ml of the following 3 different water quality.

1- Fresh water as a control (E.C. = 0.47 dSm^{-1}).

2- Primary treated sanitary water obtained from Zenein Waste Water Treatment Plant, Zenein, Giza. The chemical properties and pathological characteristics in 3 samples of the used sanitary water are shown in Tables (2) and (3), respectively.

3- A mixture of fresh and sanitary water at equal volume (1:1, v/v) used as a mixed water treatment.

Throughout the course of this study, plants were irrigated once every 2 days with 350 ml of the various water qualities used.

Jasmine oil (the essential oil extracted from flowers of *Jasminum grandiflorum*, which contains the main following components: cis-3-hexanol (3%), cis-3-hexenylacetate (4.5%), linalool L (59%), benzyl acetate (22.5%), methyl anthranilate (1.5%), methyl salicylate (2%), methyl benzoate (4.5%) and benzyl benzoate (3%), besides variable amounts of indole, cis-jasmane, geraniol, P-cresol, farnesol, eugenol, nerol, benzoic acid, benzaldehyde, Beale and Ward (1998) was dissolved in 20% ethanol and sprayed as an aqueous solution on the foliage of treated plants till the solution was run-off after one month from planting (on May 1st), 3 times with 15 days interval at the concentrations of 0.00, 0.03 and 0.05%.

Each type of water was combined with each level of jasmine oil to form 9 interaction treatments.

The plants of each tree species were arranged for each season in randomized block design with factorial concept replicated thrice, as each replicate contained 5 seedlings, i.e., 15 seedlings in each treatment (Mead *et al*., 1993). All plants under various treatments received the usual agricultural practices whenever required.

At the end of each season (on October, 30th), data were recorded as follows: plant height (cm), number of leaves/plant, stem diameter at the base (cm), number of branches/plant, root length (cm), number of rootlets/main root as well as fresh and dry weights of stem, leaves and roots (g). In fresh leaf samples taken from the middle parts of the plants in the 2nd season only, photosynthetic pigments content (chlorophyll a, b and carotenoids, mg/g f.w.) was determined according to the method of Moran (1982), while in dry samples of stem, leaves and roots, the percentages of total soluble sugars (Dubois *et al*., 1956), nitrogen (Pregl, 1945), phosphorus (Luatanab and Olsen, 1965), potassium (Jackson, 1973) as well as the content of lead (Pb) and cadmium (Cd) in ppm (Jackson, 1973) were measured.

Table 1. Some physical and chemical properties of clay used in the two seasons.

Season	Practical size distribution (%)				S.P.	pH	E.C.	Cations (meq/l)				Anions (meq/l)		
	Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	$SO4^{--}$
2013	7.54	22.28	30.55	39.63	55.00	8.0	1.81	7.82	2.12	15.40	0.75	6.60	8.20	11.30
2014	7.64	22.50	30.15	39.71	52.38	8.1	2.33	7.50	2.20	15.50	0.75	6.78	8.02	11.20

Table 2. Chemical properties of the 3 samples of sanitary water used in both seasons.

Sample	Ec (ds/m)	pH	Cations (meq/l)				Anions (meq/l)			Heavy metals (ppm)						
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	SO_4^{--}	Fe	Zn	Mn	Cu	Co	Cd	Pb
1	0.66	8.40	1.74	1.19	0.72	3.01	2.56	2.81	1.29	0.99	0.46	0.05	0.90	0.002	0.012	0.072
2	0.79	9.00	1.50	1.88	1.33	2.10	1.97	2.96	1.88	0.86	0.67	0.03	1.00	0.004	0.015	0.063
3	0.71	8.76	1.62	1.55	1.04	2.60	2.30	2.58	1.93	0.93	0.56	0.04	0.95	0.003	0.013	0.068

Table 3. Detection of pathogenic indicators, Salmonella & tshigella and human parasites in the three samples of sanitary water used in both seasons.

Pathogenic indicators	Detection			Human parasites	Detection		
	1	2	3		1	2	3
Total coliform becteria	d	d	d	***E. Histylotica Cyst.***	d	d	d
Fecal coliform becteria	d	d	d	***G. lamblea***	d	d	nd
Salmonella & tshigella	d	nd	d	***E. coli*, Round-and Hook worms**	d	d	d

d = detected, and nd = non detected.

Data were then tabulated and the morphological ones were subjected to analysis of variance using SAS Institute program (1994) followed Duncan's Multiple Range Test (Duncan, 1955) to elucidate the significancy among various treatments.

RESULTS AND DISCUSSION

Part I. Effect of water type, jasmine oil and their interaction on growth and chemical composition of *Casuarina equisetifolia* L. plants:

1- Effect on vegetative and root growth characters:

It is evident from data averaged in Tables (4 a and b) and (5) that mixed water treatment significantly improved all vegetative and root growth traits over control in the two seasons, while irrigation with sanitary water gave values of some traits closely near to those of control with non-significant differences among them despite improving fresh and dry weights of stem, leaves and roots relatively better than control in both seasons. On the other side, a progressive increment was observed in means of all vegetative and root growth parameters as a result of spraying with the gradual increasing in jasmine oil concentration to reach the maximum by 0.05% level in the two seasons. Combining between water type and jasmine oil spraying greatly improved growth performance, with the superiority of connecting between mixed water irrigation and 0.05% jasmine oil spraying, as this combination recorded the utmost high means of various vegetative and root growth criteria over the other combinations in the two seasons. In general, the least growth rate was noticed in plants irrigated with 100% sanitary water in the absence of jasmine oil treatment.

Table 4a. Effect of water type, jasmine oil and their interaction on some growth parameters of *Casuarina equisetifolia* L. plants during 2013 and 2014 seasons.

Water type \ Jasmine oil	Plant height (cm)				No. of leaves/plant				Stem diameter (cm)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
First season (2013)												
Fresh water	98.33cd	103.22c	113.48b	105.01b	269.10d	282.56c	305.21b	285.62b	0.66c	0.70bc	0.76ab	0.71ab
Mixed water	107.18bc	112.51b	129.72a	116.47a	287.32c	310.00b	333.00a	310.11a	0.72b	0.76ab	0.83a	0.77a
Sanitary water	89.33d	101.50c	122.67ab	104.50b	237.00e	281.00c	329.36a	282.45b	0.65c	0.72b	0.69bc	0.69b
Mean	98.28c	105.74b	121.96a		264.47c	291.19b	322.52a		0.68b	0.73ab	0.76a	
Second season (2014)												
Fresh water	97.00bc	102.00b	110.36ab	103.12b	261.33d	274.50c	296.96bc	277.43c	0.65b	0.69b	0.75ab	0.70a
Mixed water	104.96b	110.19ab	121.20a	112.12a	274.50c	300.67b	340.49a	305.22a	0.71b	0.77ab	0.81a	0.76a
Sanitary water	90.67c	103.38b	121.00a	105.02b	233.00e	308.43b	336.71a	292.71b	0.69b	0.71b	0.73ab	0.71a
Mean	97.54c	105.19b	117.52a		256.28c	294.53b	324.55a		0.68b	0.72ab	0.76a	

Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level.

Table 4b. Effect of water type, jasmine oil and their interaction on some growth parameters of *Casuarina equisetifolia* L. plants during 2013 and 2014 seasons.

Water type \ Jasmine oil	No. branches/plant				Root length (cm)				No. rootlets/main root			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
First season (2013)												
Fresh water	10.00c	10.80bc	11.67b	10.85b	55.20d	58.00cd	62.64b	58.61b	4.00c	4.20bc	4.54b	4.25b
Mixed water	11.01bc	11.78b	13.73a	12.17a	60.17c	63.30b	68.33a	63.93a	4.41b	4.59b	5.50a	4.83a
Sanitary water	9.00d	10.67bc	12.38ab	10.68b	46.80e	61.00bc	63.50b	57.10b	3.00d	5.10ab	5.69a	4.60ab
Mean	10.00b	11.08ab	12.59a		54.06c	60.77b	64.82a		3.80c	4.63b	5.21a	
Second season (2014)												
Fresh water	10.76c	11.30b	12.21ab	11.42ab	57.33cd	60.20c	65.00b	60.84b	4.47c	4.70bc	5.08b	4.75b
Mixed water	11.78b	12.32ab	13.41a	12.50a	62.50bc	65.40b	71.30a	66.40a	4.90bc	5.12b	6.03a	5.35a
Sanitary water	9.33d	11.00bc	12.67a	11.00b	48.00d	60.00c	65.17b	57.72b	3.33d	5.00b	6.00a	4.78b
Mean	10.62b	11.54ab	12.76a		55.94c	61.87b	67.16a		4.23c	4.94b	5.70a	

Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level.

Table 5. Effect of water type, jasmine oil and their interaction on fresh and dry weights of *Casuarina equisetifolia* L. stem, leaves and roots during 2013 and 2014 seasons.

Water type \ Jasmine oil	Stem fresh weight (g)				Leaves fresh weight (g)				Roots fresh weight (g)			
	0.00%	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**
						First season (2013)						
Fresh water	13.01d	13.90cd	15.03c	13.96b	25.74f	27.00e	29.61d	27.45b	5.79c	6.10bc	6.79b	6.16b
Mixed water	14.20cd	20.71ab	22.56a	19.16a	28.33e	34.70b	38.15a	33.73a	6.37b	8.18ab	8.97a	7.84a
Sanitary water	12.79d	12.08b	20.78ab	17.88ab	23.91f	32.67c	36.91ab	31.16ab	5.46c	7.93ab	8.15ab	7.18ab
Mean	13.67b	17.90ab	19.46a		25.99c	31.46b	34.89a		5.87b	7.40ab	7.90a	
						Second season (2014)						
Fresh water	14.26d	15.33cd	16.56c	15.36b	27.00e	28.36d	30.63c	28.66c	6.04c	6.38bc	7.00b	6.47b
Mixed water	15.50cd	19.67ab	22.90a	19.36a	30.00c	37.35ab	40.00a	35.78a	6.65b	9.60ab	10.46a	8.90a
Sanitary water	13.83d	15.54b	21.60ab	17.99ab	26.33c	35.00b	36.10b	32.48b	5.91c	8.85ab	9.68ab	8.15ab
Mean	14.51b	17.85ab	20.35a		27.78b	33.57ab	35.58a		6.20c	8.28b	9.05a	
Water type \ Jasmine oil	**Stem dry weight (g)**				**Leaves dry weight (g)**				**Roots dry weight (g)**			
	0.00%	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**
						First season (2013)						
Fresh water	6.00d	6.31cd	6.98c	6.43b	8.66de	9.12d	10.30c	9.36b	2.98d	3.16cd	3.50c	3.21b
Mixed water	7.41c	9.70ab	10.53a	9.21a	9.37cd	9.98c	14.52a	11.29a	3.37c	4.50ab	5.00a	4.29a
Sanitary water	6.82cd	8.92b	9.67ab	8.47ab	8.20e	11.05bc	12.40b	10.55ab	3.12cd	4.10b	4.23b	2.82ab
Mean	6.79b	8.31ab	9.06a		8.74c	10.05b	12.41a		3.16c	3.92b	4.24a	
						Second season (2014)						
Fresh water	6.48d	6.83cd	7.48c	6.93b	8.79d	9.34cd	10.09c	9.41b	3.12d	3.39cd	3.72c	3.41b
Mixed water	7.52c	9.81ab	11.23a	8.52a	9.60c	12.75a	13.10a	11.82a	3.50c	4.91ab	5.33a	4.58a
Sanitary water	6.92cd	9.06b	10.32ab	8.77ab	8.30d	11.74b	12.03ab	10.69ab	3.10d	4.50b	4.82ab	4.14ab
Mean	6.97b	8.57ab	9.68a		8.90b	11.28a	11.74a		3.24b	4.27ab	4.62a	

Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level.

Improvement growth or some growth parameters of plants irrigated with either sanitary or mixed water indicate the direct role of such water types in correcting soil fertility by adding some nutrients and organic matter, which in turn improve soil physical and chemical properties (Verma *et al*., 1991 and Kanekar *et al*., 1993), whilst growth reduction may be refer to accumulation of some toxic elements which may cause chlorosis, leaf defoliation and some physiological disorders (Gogate *et al*., 1995), or may be due to contamination with some pathogens and parasites that cause some diseases which negatively affecting growth and health of plants (Norman *et al*., 2003). Analogous observations were also attained by Poraas (2000) on *Eucalyptus batryoides* and *Casuarina tenussima*, Hassan (2005) on *Khaya senegalensis, Swiettenia mahogony* and *Taxodium distichum*, Abdalla (2007) on *Strelitzia reginae* and *Dianthus caryophyllus* and Odindo *et al*. (2013) who reported that bean (*Phasealus vulgaris*) seeds germinated using waste effluent showed radicle protrusion earlier than those under tap water, radicles were longer and produced more root mass compared to those germinated using tap water. Swiss chard (*Beta vulgaris*) plants irrigated with waste effluent gave better dry matter and leaf area than those irrigated with tap water.

Besides, jasmine oil activates vital processes in the treated plants, involved in most events of plant development and plays a marked cell signaling role in defensive responses of plants (Moreira *et al*., 2012 and Lombardero *et al*., 2013). It is able to regulate ethylene biosynthesis, reduce injuries of the environmental stresses, induce stomatal closure (Kondo, 2010) and decrease chilling injury (Gonzalez-Aquilar *et al*., 2003). The previous gains, however were supported by those of Naidoo *et al*. (2013) on *Eucalyptus grandis,* Boeckler *et al*. (2013) on *Populus nigra and* Sunil *et al*. (2014) on loquat.

2- Effect on chemical composition:

Data in Table (6) exhibit that chlorophyll a, b and carotenoids content in the leaves (mg/g f.w.) was greatly increased relative to control content in response to either mixed or sanitary water treatments, with the prevalence of the former one, which registered the highest content at all. This may be ascribed to presence of macro-and micro-nutrients and organic matter in sanitary or mixed water, which are necessary for promoting stroma lamella formation and grana and chlorophyll appearance during normal leaf growth.

On the other hand, means of these pigments were linearly increased with increasing jasmine oil concentration except of chlorophyll b content which pronouncedly decreased to be 0.149 and 0.232 mg/g f.w. in the leaves of plants sprayed with 0.03 and 0.05% concentrations, respectively against 0.388 mg/g f.w. in the leaves of untreated plants. Increment content of some pigments might be reasonably excepted because jasmine oil usually activates some enzymatic systems in plant tissues which affect the biosynthesis of active constituents in these tissues (Beale and Ward, 1998). In this connection, Tamari *et al.* (1995) declared that jasmontes induced the pigmentation and flavonoid gene expression in *Petunia hybrida* corollas. This was also affirmed by Kondo (2010) who found that n-propyl dihydrogasmonate application increased coloration of apples fruits. Interactions also enhanced pigments formation, with the mastery of mixed water treatment that scored the highest content of chlorophyll a and carotenoids in the leaves of plants sprayed with 0.05% jasmine oil solution. That was true for chlorophyll b content when plants were also irrigated with mixed water, but in the absence of jasmine oil treatment.

Results of total soluble sugars, N, P and K percentages recorded in Tables (7 and 8) showed a similar trend to that of pigments, as the content of these components clearly increased in the stem, leaves and roots as a results of using either sanitary water (alone or in a mixture) or spraying the foliage with jasmine oil solution. The highest content of them was also due to the connecting between

Table 6. Effect of water type, jasmine oil and their interaction on photosynthetic pigments in *Casuarina equisetifolia* L. leaves during 2014 season.

Jasmine oil / Water type	Chlorophyll a (mg/g f.w.)				Chlorophyll b (mg/g f.w.)				Carotenoids (mg/g f.w.)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
Fresh water	0.208	0.219	0.237	0.221	0.092	0.106	0.128	0.109	0.066	0.078	0.089	0.078
Mixed water	0.291	0.471	0.545	0.436	1.003	0.174	0.291	0.489	0.110	0.136	0.273	0.173
Sanitary water	0.269	0.440	0.533	0.414	0.070	0.166	0.276	0.171	0.096	0.128	0.259	0.161
Mean	0.256	0.377	0.438		0.388	0.149	0.232		0.091	0.114	0.207	

Table 7. Effect of water type, jasmine oil and their interaction on total carbohydrates and nitrogen content in *Casuarina equisetifolia* L. stem, leaves and roots during 2014 season.

Jasmine oil / Water type	Total soluble sugars in the stem (%)				Total soluble sugars in the leaves (%)				Total soluble sugars in the roots (%)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
Fresh water	5.510	5.786	6.264	5.853	3.245	3.413	3.701	3.453	4.476	4.728	5.108	4.771
Mixed water	6.000	6.535	7.123	6.553	3.818	4.905	6.509	5.077	4.807	6.213	8.176	6.399
Sanitary water	4.168	5.580	10.840	6.683	3.527	4.484	8.013	5.341	3.711	5.769	7.580	5.687
Mean	5.226	5.967	8.076		3.530	4.267	6.074		4.331	5.570	6.955	
	N in the stem (%)				N in the leaves (%)				N in the roots (%)			
Fresh water	1.586	1.667	1.803	1.685	1.493	1.568	1.694	1.585	1.633	1.715	1.852	1.733
Mixed water	1.745	1.901	2.071	1.906	1.640	2.063	2.150	1.951	1.780	1.873	2.044	1.899
Sanitary water	1.773	1.820	1.913	1.835	1.820	1.913	1.970	1.901	2.100	1.650	1.680	1.810
Mean	1.701	1.796	1.929		1.651	1.848	1.938		1.838	1.746	1.859	

Table 8. Effect of water type, jasmine oil and their interaction on phosphorus, potassium, lead and cadmium in *Casuarina equisetifolia* L. stem, leaves and roots during 2014 season.

Jasmine oil / Water type	P in the stem (%)				P in the leaves (%)				P in the roots (%)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
Fresh water	0.219	0.230	0.249	0.233	0.152	0.161	0.176	0.163	0.205	0.217	0.235	0.219
Mixed water	0.240	0.261	0.309	0.270	0.179	0.203	0.217	0.200	0.230	0.272	0.296	0.266
Sanitary water	0.237	0.262	0.345	0.281	0.235	0.247	0.295	0.259	0.275	0.290	0.298	0.288
Mean	0.232	0.251	0.301		0.189	0.204	0.229		0.237	0.260	0.276	
	K in the stem (%)				**K in the leaves (%)**				**K in the roots (%)**			
Fresh water	1.370	1.440	1.564	1.458	1.312	1.378	1.490	1.393	1.351	1.420	1.534	1.435
Mixed water	1.493	1.581	1.701	1.592	1.431	1.580	1.612	1.541	1.472	1.604	1.500	1.609
Sanitary water	1.446	1.485	1.561	1.497	1.485	1.571	1.580	1.545	1.355	1.485	1.619	1.486
Mean	1.436	1.502	1.609		1.409	1.510	1.561		1.393	1.503	1.634	
	Pb in the stem (ppm)				**Pb in the leaves (ppm)**				**Pb in the roots (ppm)**			
Fresh water	0.459	0.434	0.399	0.431	0.588	0.491	0.467	0.515	0.735	0.567	0.329	0.544
Mixed water	0.682	0.526	0.493	0.550	1.123	0.948	0.721	0.931	1.240	1.053	0.889	1.061
Sanitary water	1.827	1.297	1.084	1.403	1.669	1.178	0.962	1.270	2.393	2.031	1.470	1.965
Mean	0.989	0.752	0.642		1.127	0.872	0.717		1.456	1.217	0.896	
	Cd in the stem (ppm)				**Cd in the leaves (ppm)**				**Cd in the roots (ppm)**			
Fresh water	0.326	0.287	0.103	0.239	0.027	0.024	0.017	0.023	0.401	0.311	0.230	0.314
Mixed water	0.350	0.296	0.182	0.276	0.183	0.135	0.096	0.138	0.569	0.413	0.319	0.434
Sanitary water	0.416	0.301	0.214	0.310	0.269	0.194	0.141	0.201	0.738	0.530	0.385	0.551
Mean	0.364	0.295	0.166		0.160	0.118	0.085		0.569	0.418	0.311	

irrigation with mixed water and spraying with jasmine oil at high rate (0.05%). Moreover, mixed water often gave higher content of such constituents than sanitary one and content of them was progressively raised as the level of jasmine oil was increased. In this regard, Ozturk (2013) indicated that jasmine oil slow some vital processes such as respiration, while enhance juvenility leading to consumption of sugars by hindering ethylene action and retarding the quick senescence of plant organs, and in turn utilization of sugars. However, the least averages of these constituents were attained by control plants with few exceptions.

The content of Pb and Cd in the stem, leaves and roots (ppm) was gradually increased with increasing the percent of sanitary water in irrigation water to reach the maximum when the absolute sanitary water was used for irrigation. This, of course attributed to the presence of these metals in mixed or sanitary water used in this study (Table, 2). In this concern, Hunshal *et al.* (2000) noted that increasing chemical constituents in plant tissues may be refer to the higher content of suspended solids, solutes and total N in the used sanitary water. The opposite was the right concerning jasmine oil treatments which were progressively reduced content of such two elements in the different plant organs with increasing its concentration in spray solution. Therefore, the least content of both Pb and Cd was noticed in organs of plants sprayed with the high rate of jasmine oil (0.05%), especially under fresh water treatment, while the highest content explored in plants irrigated with 100% sanitary water and received no jasmine oil treatment. Generally, accumulation of Pb and Cd in the roots was, to some extent higher than their accumulation in the stem and leaves, but this did not lead to any morpho- or phsio-logical disorders in plants because the concentrations of them did not surpassed the critical levels, which were 30-35 ppm for both as mentioned by Macnicol and Bockett (1985).

The trend of previous results, however, coincides with those postulated by Abbas (2002) on *Casuarina glauca*, Shahin and El-Malt (2006) on *Acacia nilotica,Quercus suber* and *Tipuana tipu*, Semiz *et al.* (2012) on *Pinus sylvestris* and *Quercus ilex*, Ozturk *et al.* (2013) on "Fuji" apples and Odindo *et al.* (2013) who mentioned that high P concentration in the waste effluent may be associated with increased P content, shoot mass and extensive root growth of bean and Swiss chard.

Part II. Effect of water type, jasmine oil and their interaction on growth and chemical composition of *Eucalyptus rostrata* Schlecht. plants.

1- Effect on vegetative and root growth parameters:

Similar observations to those obtained in case of vegetative and root growth parameters of *Casuarina* plant (Part I) were also gained in Eucalyptus, where all vegetative and root growth measurements presented in Tables (9 a and b) and (10); expressed as plant height (cm), number of branches and leaves/plant, stem diameter (cm), root length (cm), number of rootlets/main root as well as fresh and dry weights of stem, leaves and roots (g) were improved due to irrigation with either mixed or sanitary water, with the excellence of the former treatment (mixed water) which gave the utmost high values compared to the values recorded by sanitary water in most instances of both seasons. Also, the means of such criteria were cumulatively elevated with rising jasmine oil concentration to be significantly higher than those of control with few exceptions in the two seasons. However, the mastership in both seasons was also for the high rate (0.05%). Concerning the effect of interaction treatments, they were caused a marked improve in the different growth traits, with the dominance of the interaction between mixed water treatment and spraying with jasmine oil at 0.05% level, which gave the best growth in the two seasons at all. On the other hand, the least records were registered

Table 9a. Effect of water type, jasmine oil and their interaction on some growth parameters of *Eucalyptus rostrata* Schlecht. plants during 2013 and 2014 seasons.

Water type \ Jasmine oil	Plant height (cm)				No. of leaves/plant				Stem diameter (cm)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
First season (2013)												
Fresh water	122.00d	128.10cd	139.35bc	129.82c	89.39c	91.97c	99.37b	93.56b	0.69c	0.74c	0.83bc	0.75b
Mixed water	133.00c	142.95b	158.10a	144.68a	94.83c	103.35b	114.66a	104.28a	0.99b	1.09a	1.18a	1.09a
Sanitary water	122.76d	133.67c	142.00b	132.81b	48.33d	97.33bc	113.00a	86.22c	1.01b	1.07ab	1.11a	1.06a
Mean	125.92c	134.91b	146.48a		77.50c	97.55b	109.01a		0.90c	0.97b	1.04a	
Second season (2014)												
Fresh water	118.67d	124.00cd	132.98c	125.22b	75.00cd	80.34c	86.91b	80.75a	0.72c	0.76bc	0.86b	0.78b
Mixed water	130.00c	142.38b	155.11a	142.50a	71.30d	84.70b	93.32a	83.11a	0.87b	1.02a	1.11a	1.00a
Sanitary water	122.66cd	135.67bc	142.33b	133.55ab	50.33c	81.46bc	82.67bc	71.49b	0.99ab	1.05a	1.08a	1.04a
Mean	123.78c	134.02b	143.47a		65.54c	82.17b	87.63a		0.86c	0.94b	1.02a	

Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level.

Table 9b. Effect of water type, jasmine oil and their interaction on some growth parameters of *Eucalyptus rostrata* Schlecht. plants during 2013 and 2014 seasons.

Water type \ Jasmine oil	No. branches/plant				Root length (cm)				No. rootlets/main root			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
First season (2013)												
Fresh water	2.67c	2.83c	3.08bc	2.86b	31.50d	33.08cd	36.40c	33.66b	3.00c	3.15bc	3.52bc	3.22b
Mixed water	3.33bc	4.56ab	5.21a	4.37a	35.90cd	43.60b	47.50a	42.33a	4.17b	5.46ab	6.48a	5.37a
Sanitary water	3.00c	4.00b	4.33ab	3.78ab	37.00c	40.10bc	43.51b	40.20ab	4.00b	5.33ab	6.27a	5.20a
Mean	3.00c	3.80b	4.21a		39.80c	38.93b	42.47a		3.72c	4.65b	5.42a	
Second season (2014)												
Fresh water	2.00d	2.40cd	2.67c	2.36b	29.79d	32.00cd	35.56c	32.45b	2.67d	2.81d	3.34c	2.94b
Mixed water	3.10b	4.03ab	4.94a	4.02a	32.70cd	38.50bc	45.00a	38.73a	2.93cd	5.13ab	6.09a	4.72a
Sanitary water	3.00bc	3.76b	4.93ab	3.70ab	35.01c	37.94bc	41.15b	38.03a	3.58c	4.72b	5.81a	4.70a
Mean	2.70c	3.40b	3.98a		32.50c	36.15b	40.57a		3.05c	4.22b	5.08a	

Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level.

Table 10. Effect of water type, jasmine oil and their interaction on fresh and dry weights of *Eucalyptus rostrata* Schlecht. plants during 2013 and 2014 seasons.

Jasmine oil / Water type	Stem fresh weight (g)				Leaves fresh weight (g)				Roots fresh weight (g)			
	0.00%	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**
First season (2013)												
Fresh water	15.64e	16.47e	17.82de	16.64b	13.29c	14.00c	15.20bc	14.16c	5.95e	6.30de	7.84d	6.70b
Mixed water	21.41d	34.50b	41.76a	32.56a	14.20c	17.50b	22.91a	18.20a	7.33d	11.05c	16.95a	11.78a
Sanitary water	28.31c	32.50bc	40.65a	33.82a	9.89d	16.40b	21.13a	15.81b	10.15cd	13.35b	15.62a	13.04a
Mean	21.79c	27.82b	33.41a		12.46c	15.97b	19.75a		7.81c	10.23b	13.47a	
Second season (2014)												
Fresh water	21.26d	22.33cd	24.12c	22.57b	12.36cd	13.10cd	14.20bc	13.22b	7.26e	7.67de	8.32d	7.75b
Mixed water	24.68c	38.00ab	41.58a	34.75a	13.60c	15.56b	18.79a	15.98a	12.00c	14.16b	17.56a	14.61a
Sanitary water	31.00bc	35.80b	38.91ab	35.00a	10.46d	14.51b	17.20a	14.06b	11.47c	14.50b	16.36a	14.11a
Mean	25.65c	31.80b	34.87a		12.14c	14.39b	16.73a		10.24c	12.11b	14.11a	

Jasmine oil / Water type	Stem dry weight (g)				Leaves dry weight (g)				Roots dry weight (g)			
	0.00%	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**	**0.00%**	**0.03%**	**0.05%**	**Mean**
First season (2013)												
Fresh water	5.65d	5.93d	6.42d	6.00b	3.11cd	3.27c	3.53c	3.30c	3.21e	3.38de	3.80d	3.46b
Mixed water	8.60cd	14.33b	19.03a	13.99a	3.50c	4.29b	7.76a	5.18a	4.85cd	6.76b	8.40a	6.67a
Sanitary water	10.25c	13.78b	17.56ab	13.86a	2.21d	4.00b	7.51a	4.57b	5.75c	6.89a	7.65ab	6.76a
Mean	8.17c	11.35b	14.34a		2.94b	3.85b	6.27a		4.60b	5.68ab	6.62a	
Second season (2014)												
Fresh water	8.58e	9.03de	9.90d	9.17b	3.17cd	3.34c	3.67bc	3.39b	3.42e	3.60de	3.97d	3.66b
Mixed water	10.12d	15.95ab	18.00a	14.69a	3.52bc	4.07b	5.69a	4.43a	4.54d	7.48b	8.50a	6.84a
Sanitary water	12.67c	14.56b	16.30ab	14.51a	2.45d	3.50bc	5.10a	3.68b	5.20c	7.00b	7.62ab	6.61a
Mean	10.46b	13.18ab	14.73a		3.05b	3.64b	4.82a		4.39b	6.03a	6.70a	

Means within a column or row having the same letters are not significantly different according to Duncan's Multiple Range Test at 5% level.

by plants irrigated with 100% sanitary water and abandoned of jasmine oil solution.

These results could be interpretted and discussed as done before in case of vegetative and root growth parameters of Casuarina plants.

2- Effect on chemical composition:

It is clear from data illustrated in Table (11) that mixed water is the only treatment among water types which improved chlorophyll a and carotenoids content (mg/g f.w.) in the leaves of plants irrigated with it, whereas sanitary water diminished their content to less than control. As for chlorophyll b content, it was increased by either mixed water or sanitary one recording 0.798 and 0.740 mg/g f.w. for the two water types, consecutively versus 0.487 mg/g f.w. for control. The content of these pigments, on the other side were sequentially elevated with elevating jasmine oil concentration to score the high level (0.05%) higher values than the low one (0.03%). Pigments content was also improved by combined treatments, with the supremacy of mixed water + 0.05% jasmine oil solution that gave the highest content over other combinations.

Similarly, were the percentages of total soluble sugars, N, P and K contents in the stem, leaves and roots (Tables, 12 and 13), as they were increased in response to the various treatments employed in this work, with the superiority of the individual application of either mixed water or high level of jasmine oil, as well as the interaction between them.

As observed before in case of chemical composition of Casuarina plant, content of both Pb and Cd as ppm in the stem, leaves and roots was gradually increased with increasing sanitary water percent in the used water for irrigation, but was linearly decreased with increasing jasmine oil concentration in spray solution. However, the highest content of these two metals was found in the different parts of plants irrigated with absolute sanitary water and sprayed with zero jasmine oil solution. Furthermore, content of such two metals in the roots was higher than that in stem or leaves without any physiological disorders for plants.

The previous findings may be discussed as previously mentioned when the authors discussed these active constituents in case of chemical composition of Casuarina plant (Part, I).

According to the above-mentioned results, it could be noted that sanitary water can be used after mixing it with fresh water in irrigating *Casuarina equisetifolia* L. and *Eucalyptus rostrata* Schlecht. plants provided that spraying them with jasmine oil solution at 0.05% concentration, 3 times with 15 days interval to get the best growth and highest quality.

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Table 11. Effect of water type, jasmine oil and their interaction on photosynthetic pigments content in *Eucalyptus rostrata* Schlecht. leaves during 2014 season.

Jasmine oil / Water type	Chlorophyll a (mg/g f.w.)				Chlorophyll b (mg/g f.w.)				Carotenoids (mg/g f.w.)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
Fresh water	0.899	0.943	1.020	0.954	0.460	0.481	0.520	0.487	0.243	0.256	0.283	0.261
Mixed water	0.990	1.037	1.123	1.050	0.638	0.770	0.986	0.798	0.310	0.298	0.310	0.306
Sanitary water	0.480	0.907	0.974	0.787	0.587	0.719	0.915	0.740	0.282	0.122	0.184	0.196
Mean	0.790	0.962	1.039		0.562	0.657	0.807		0.278	0.225	0.259	

Table 12. Effect of water type, jasmine oil and their interaction on total soluble sugars and nitrogen content in *Eucalyptus rostrata* Schlecht. stem, leaves and roots during 2014 season.

Jasmine oil / Water type	Total soluble sugars in the stem (%)				Total soluble sugars in the leaves (%)				Total soluble sugars in the roots (%)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
Fresh water	1.896	2.000	2.169	2.022	3.049	3.203	3.460	3.237	4.798	5.041	5.451	5.097
Mixed water	2.100	3.125	3.536	2.920	3.400	3.739	7.000	4.713	5.280	5.909	13.860	8.350
Sanitary water	1.835	2.890	3.213	2.629	3.094	3.365	6.271	4.243	3.046	3.740	12.680	6.489
Mean	1.944	2.655	2.973		3.181	3.436	5.577		4.375	4.897	10.664	
	N in the stem (%)				N in the leaves (%)				N in the roots (%)			
Fresh water	1.586	1.680	1.815	1.694	1.680	1.764	1.960	1.801	1.213	1.276	1.401	1.297
Mixed water	1.850	2.032	2.209	2.030	2.061	2.365	2.453	2.293	2.100	2.264	2.376	2.247
Sanitary water	1.680	1.821	2.006	1.836	1.867	2.146	2.210	2.074	1.960	2.053	2.147	2.053
Mean	1.705	1.844	2.010		1.869	2.092	2.208		1.758	1.864	1.975	

Table 13. Effect of water type, jasmine oil and their interaction on phosphorus, potassium, lead and cadmium in *Eucalyptus rostrata* Schlecht. stem, leaves and roots during 2014 season.

Jasmine oil / Water type	P in the stem (%)				P in the leaves (%)				P in the roots (%)			
	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean	0.00%	0.03%	0.05%	Mean
Fresh water	0.241	0.253	0.276	0.257	0.289	0.304	0.329	0.307	0.161	0.171	0.190	0.174
Mixed water	0.337	0.351	1.479	0.722	0.340	0.469	0.580	0.463	0.326	0.418	0.450	0.398
Sanitary water	0.306	0.316	0.451	0.358	0.308	0.427	0.531	0.422	0.302	0.384	0.427	0.371
Mean	0.295	0.307	0.735		0.312	0.400	0.480		0.263	0.324	0.356	
	K in the stem (%)				**K in the leaves (%)**				**K in the roots (%)**			
Fresh water	1.370	1.439	1.554	1.954	1.485	1.559	1.681	1.575	1.312	1.379	1.480	1.390
Mixed water	1.539	1.629	1.980	1.716	1.592	1.650	1.850	1.681	1.410	1.595	1.643	1.549
Sanitary water	1.410	1.478	1.801	1.563	1.293	1.485	1.561	1.496	1.379	1.446	1.485	1.437
Mean	1.440	1.515	1.778		1.440	1.565	1.697		1.367	1.473	1.536	
	Pb in the stem (ppm)				**Pb in the leaves (ppm)**				**Pb in the roots (ppm)**			
Fresh water	0.438	0.327	0.269	0.345	0.330	0.265	0.203	0.266	0.582	0.447	0.323	0.451
Mixed water	0.525	0.389	0.304	0.406	0.582	0.438	0.305	0.442	0.973	0.701	0.506	0.727
Sanitary water	0.694	0.502	0.369	0.522	0.641	0.504	0.394	0.513	1.479	1.190	0.860	1.176
Mean	0.552	0.406	0.314		0.518	0.402	0.301		1.011	0.779	0.563	
	Cd in the stem (ppm)				**Cd in the leaves (ppm)**				**Cd in the roots (ppm)**			
Fresh water	0.025	0.021	0.015	0.020	0.021	0.018	0.016	0.018	0.071	0.060	0.044	0.058
Mixed water	0.037	0.028	0.022	0.029	0.044	0.031	0.024	0.033	0.119	0.101	0.073	0.098
Sanitary water	0.084	0.071	0.052	0.069	0.081	0.069	0.049	0.066	0.315	0.261	0.194	0.257
Mean	0.049	0.040	0.030		0.049	0.039	0.030		0.168	0.141	0.104	

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تقليل الآثار الضارة لمياه الصرف الصحي على نمو وجودة بعض الأشجار ذات القيمة الاقتصادية باستخدام زيت الياسمين

سيد محمد شاهين و عاطف سيد طويلة
قسم بحوث الحدائق النباتية، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر.

أجريت هذه التجربة بالعراء بمشتل معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال موسمي ٢٠١٣، ٢٠١٤ لدراسة تأثير جودة أنواع مختلفة من المياه (المياه العذبة، المياه المخلوطة (٥٠ % ماء عذب + ٥٠ % ماء صرف صحى) ومياه الصرف الصحي المعالجة أولياً)، التركيزات المختلفة من زيت الياسمين (صفر، ٠.٠٣، ٠.٠٥ %) عند إضافتها فى صورة محلول مائى رشاً على الأوراق، ثلاث مرات وبفاصل ١٥ يوماً بين كل رشتين وكذلك التفاعلات بينهما على النمو والتركيب الكيميائى لشتلات عمر سنة من أشجار الجازورينا (*Casuarina equisetifolia* L.) و الكافور (*Eucalyptus rostrata* Schlecht.) المنزرعة فى أكياس بلاستيك سوداء قطرها ١٦ سم، ملأت بحوالي ٣.٥ كجم تربة طينية.

أوضحت النتائج المتحصل عليها أن جميع صفات النمو الخضري والجذري لنباتات الأشجار موضع الدراسة قد زادت معنوياً استجابة للمعاملات الفردية والتفاعلات المختلفة التى استخدمت بهذه الدراسة. تم أيضاً الحصول على اتجاه مشابه فيما يتعلق بمحتوى الأوراق من كلوروفيللى أ، ب والكاروتينويدات، ومحتوى الساق، والأوراق والجذور من السكريات الكلية الذائبة، النتروجين، الفوسفور والبوتاسيوم والتي زادت بشكل واضح نتيجة للمعاملات المختلفة المطبقة بهذه الدراسة.

على الجانب الأخر فإن محتوى الساق، الأوراق والجذور من عنصري الرصاص والكادميوم قد زاد بوضوح بزيادة نسبة مياه الصرف فى مياه الري، لكنه انخفض تدريجياً بزيادة تركيز زيت الياسمين فى محلول الرش. وبصفه عامة فإن محتوى هذين المعدنين فى أعضاء النبات المختلفة كان أقل بكثير من المستويات الحرجة لها، لذا لم تظهر أية اضطرابات ظاهرية أو فسيولوجية على نباتات نوعى الأشجار المستخدمة موضع الدراسة.

ولقد كانت السيادة والتفوق فى جميع القياسات السابقة لمعاملة الجمع بين الري بالمياه المخلوطة والرش بمحلول زيت الياسمين (٠.٠٥ %) والتي أعطت أفضل معدل للنمو الخضري والجذري وأعلى محتوى للصبغات، السكريات الكلية الذائبة، النتروجين، الفوسفور والبوتاسيوم في أنسجة النبات المختلفة والذي كان مصحوباً بأقل محتوى من عنصري الرصاص والكادميوم.

وعليه نستطيع القول بأنه يمكن استخدام مياه الصرف المعالجة أولياً بعد خلطها مع المياه العذبة بنسبة متساوية فى ري شتلات أشجار الجازورينا والكافور بشرط رش هذه النباتات بمحلول زيت الياسمين (٠.٠٥ %) ثلاث مرات وبفاصل خمسة عشر يوماً بين كل رشتين للحصول على أفضل نمو وأعلى جودة.