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Growth of olive varieties in tunnel under salinity plus humic acid, biozote and vermicompost

*Muhammad Arshad Ullah[1], Syeda Sana Aamir[1], Hussain Haider[2], Bilal Adil[2] Imdad Ali Mahmood[1], Badar-uz-Zaman [1] and Syed Ishtiaq Hyder[1]
[1] National Agricultural Research Centre, Park Road, Islamabad-45500, Pakistan
[2] Institute of Soil Sciences, University of Arid Agriculture, Rawalpindi, Punjab, Pakistan
*Corresponding Author

Abstract

The study was carried out at NARC Islamabad during August, 2017 to October, 2017 to probe the impact of salinity plus humic acid, Biozote and Vermicompost on 3 olive varieties i.e. *Nocellera, Frontoio* and Carolea. Completely randomized design was applied with three replications. Olive Soil salinity was developed artificially with the mixture of different salts at 2.0 dSm^{-1}. Biozote, humic acid and Vermicompost were applied in the artificially developed soil salinity filled in polythene bags planted three months olive cuttings. Treatments were; humic acid solid to mix with soil at the time of planting, humic acid liquid to soil at the time of planting, humic acid spray to cuttings (after every 10 days), dip cuttings in humic acid at the time of planting. addition of vermizote in soil at the time of planting, addition of Biozote in soil at the time of planting and dip cutting in Biozote at the time of planting. Results of this study indicated that Carolea Olive variety attained the highest values in stem diameter, root dry weight, stem fresh weight, stem dry weight, leaf fresh weight, leaf dry weight, shoot fresh weight, shoot dry weight growth parameters while Frontoio Olive variety attained the best in roots fresh weight, and chlorophyll contents under salinity plus humic acid, Biozote and Vermicompost. Leaf area was the highest in Nocellera olive variety in salinity plus humic acid, Biozote and Vermicompost treatments.

Keywords: Nocellera, Frontoio and Coratina olive varieties, salinity, humic acid, Biozote, Vermicompost and olive growth

Introduction

Salinity is one of the most important environmental factors, limiting crop production in arid and semi-arid regions (Sepaskhah and Yarami, 2010). Toxicity of Na^+ in metabolic processes results from its ability to compete with K^+ for binding sites and to inactivate enzymes and essential cellular functions and, consequently, crops growing in saline soils may suffer the dual injury of Na+ toxicity and low K^+ concentrations (Munns and Tester, 2008). For most plants to tolerate salinity, Na^+ and Cl^- uptake must be restricted while maintaining the uptake of macro nutrients such as K^+, NO_3^- and Ca^{2+} (Tavakkoli *et al.*, 2011).

Olive (*Olea europaea* L) is one of the most important plants and widespread crops of the Mediterranean basin, which has longevity and adaptation to climatic conditions, also the olive fruits, are commercially valuable for oil content or for edible flesh. The olive trees productivity is generally low due to the poor soil fertility and low water holding capacity. Accordingly, it seems that trees need to organic fertilizers avoided pollution and reduced the costs of fertilization. Also, it has drowned the attention of olive growers to use the organic and biofertilizers that would be healthy for human and safe for environment (Fayed. 2010). Humic acids are the main fractions of humic substances and the most active components of soil and compost organic matter. Humic acids have been shown to stimulate plant growth and consequently yield by acting on mechanisms involved in: cell respiration, photosynthesis, protein synthesis, water and nutrient uptake, enzyme activities (Chen *et al.*, 2004). In particular, optimal concentrations able to affect and stimulate plant growth have been generally found in the range of 50-300 mg L^{-1}, but positive effects have been also exerted by lower concentrations (Chen *et al.,* 2004). A distinction on the effects of humic acids should be made between indirect and direct effects on plants growth. Indirect effects are mainly exerted through properties such as: enrichment in soil nutrients, increase of microbial population, higher action exchange capacity, improvement of soil structure; whereas direct effects are various biochemical actions exerted at the cell wall, membrane or cytoplasm and mainly of hormonal nature (Varanini and Penton, 2001; Chen *et al.*, 2004). Magdi *et al.*, (2011) reported that, bio-fertigation of microbial inoculums and humic substances could be used as a complementary for mineral fertilizers to improve yield and quality of cowpea under sandy soil conditions which protect the environment chemical pollution and its harmful effect on human and animal health.

A foliar application of HA increased the vegetative growth of olive cuttings (Hartwigsen *and* Evansmicheal, 2000; Muscolo and Sidari, 2007; Schmidt *et al.* 2007; Zandonadi *et al.* 2007). The positive influence of HA on plant growth and productivity, which seems to be concentration-specific, could be mainly due to the hormone-like activity of HA through its involvement in cell respiration, photosynthesis, oxidative phosphorylation, protein synthesis, and various enzymatic reactions (Muscolo and Sidari 2007). Although HA is known to evoke a plant's growth responses similar to those induced by plant hormones, it has not yet been conclusively proved whether or not HA contains hormone-like components. However, there are indications that they might (Atiyeh *et al*., 2002; Canellas *et al.* 2008). The stimulative effect of HSs on plant growth has been related, at least in part, to the enhanced uptake of mineral nutrients. Increased uptake of macro- and micro-nutrients is influenced by HSs in different plant species (Rupiasih *and* Vidyasgar, 2008).

Vermicompost is a nutrient-rich, microbiologically-active organic amendment that results from the interactions between earthworms and microorganisms during the breakdown of organic matter. It is a stabilized, finely divided peat-like material with a low C: N ratio, high porosity and high water-holding capacity, in which most nutrients are present in forms that are readily taken up by plants (Domínguez, 2004).Vermicompost significantly stimulates the growth of a wide range of plant species including several horticultural crops such as tomato (Atiyeh *et al.*, 2000a& b; Atiyeh *et al*., 2001; Hashemimajd, *et al.*, 2004; Gutiérrez *et al*., 2007), pepper (Arancon *et al*., 2004a, Arancon *et al.,* 2005), garlic (Argüello *et al*, 2006), aubergine (Gajalakshmi and Abbasi, 2004), strawberry (Arancon *et al*., 2004b), sweet corn (Lazcano *et al*, 2011). Vermicompost has also been found to have positive effects on some aromatic and medicinal plants (Anwar *et al*., 2005; Prabha *et al.*, 2007), cereals such as sorghum and rice (Bhattacharjee *et al.*, 2001; Reddy and Ohkura, 2004; Sunil *et al*., 2005), fruit crops such as banana and papaya (Cabanas, *et al.*, 2005; Acevedo and Pire, 2004), and ornamentals such as geranium (Chand *et al*. 2007), marigolds (Atiyeh et al., 2002), petunia (Arancon *et al*., 2008), chrysanthemum (Hidalgo and Harks 2002a) and poinsettia (Hidalgo, 2002b). Positive effects of vermicompost have also been observed in forestry species such as acacia, eucalyptus and pine tree (Lazcano *et al.*, 2010a&b). Vermicompost has been found to have beneficial effects when used as a total or partial substitute for mineral fertilizer in peat-based artificial greenhouse potting media and as soil amendments in field studies. Likewise, some studies show that vermicomposting leachates or vermicompost water-extracts, used as substrate amendments or foliar sprays, also promote the growth of tomato plants (Tejada *et al.* 2008), sorghum (Gutiérrez *et al.* 2008), and strawberries (Singh , 2010).

Materials and Methods

The study was carried out at NARC Islamabad during August, 2017 to October, 2017 to probe the impact of salinity plus humic acid, Biozote and Vermicompost on 3 olive varieties i.e. Nocellera, Frontoio and Carolea. Completely randomized design was applied with three replications. Olive Soil salinity was developed artificially with the mixture of different salts at 2.0dSm^{-1}. Biozote, humic acid and Vermicompost were applied in the artificially developed soil filled in polythene bags planted three months olive cuttings. Treatments were; humic acid solid to mix with soil at the time of planting, humic acid liquid to soil at the time of planting, humic acid spray to cuttings (after every 10 days), dip cuttings in humic acid at the time of planting. addition of Vermizote in soil at the time of planting, addition of Biozote in soil at the time of planting and dip cutting in Biozote at the time of planting.

Results and Discussion

Table-1 showed results of stem diameter affected by impact of salinity plus humic acid, biozote and vermicompost within three olive varieties at 2 dSm^{-1}. Overall Corlea olive variety gained the highest stem diameter (4.19 mm) at 2 dSm^{-1}. Olive varieties and salinity plus humic acid, biozote and vermicompost inclined the Olive stem fresh weight (table-1). Carolea olive variety attained the top position in the stem fresh weight (10.34gm) at 2 dSm^{-1}

Olive stem dry weight of three olive varieties was differed with salinity plus humic acid, biozote and vermicompost as shown in table-1. Highest olive stem dry weight (5.51gm) was attained by Carolea olive variety under 2 dSm^{-1}.

Olive roots fresh weight was also affected by impact of salinity plus humic acid, biozote and vermicompost within three olive varieties at 2dSm^{-1}. However, Frontoio olive variety gained the highest roots fresh weight (1.04gm) at 2dSm^{-1} as depicted in table-1.Salinity plus humic acid, biozote and vermicompost influenced the Olive roots dry weight of three olive varieties at 2 dSm^{-1}as mentioned in table-1. Carolea olive variety gained the highest roots dry weight (0.36gm) at 2 $dSm^{-1.}$ Magdi *et al.*, (2011) reported that, bio-fertigation of microbial inoculums and humic substances could be used as a complementary for mineral fertilizers to improve yield and quality of cowpea.

Data indicated in table-2 regarding olive leaf fresh weight described the effects salinity plus humic acid, biozote and Vermicompost. Highest olive leaf fresh weight (2.59 gm) was received with Carolea olive variety by 2 dSm^{-1}. Data presented in table-2 related to olive leaf dry showed the influences of salinity plus humic acid, biozote and Vermicompost. Carolea olive variety gained the highest olive leaf dry weight (0.68 gm) at 2 dSm^{-1}.

Data regarding effect on olive shoot fresh weight by salinity plus humic acid, biozote and Vermicompost was mentioned in table-2. Carolea olive variety gained the maximum olive shoot fresh weight (0.98 gm) at 2 dSm^{-1}.Olive shoot dry weight was influenced by humic acid, biozote and Vermicompost under saline conditions in table-2. Overall, Carolea olive variety attained the upper limit of olive shoot dry weight (0.43 gm) under saline conditions.

Chlorophyll contents parameter in plant growth is the main due to photosynthesis process. Chlorophyll contents data was presented in table-2 showing variation among treatments. However, the highest chlorophyll contents (78.30 %) were measured by Frontoio olive variety with the treatments of salinity plus humic acid, biozote and Vermicompost.

Leaf area in plant is the detrimental factor in plant growth as well as in fruit development. Leaf area data was presented in table-2 describing variation among treatments and olive varieties. Resultantly the highest leaf area (31.792 cm^2) was measured by Nocellera olive variety with integrative effect of salinity plus humic acid, biozote and Vermicompost at 2 dSm^{-1}. vermicompost as foliar sprays, also promote the growth of tomato plants (Tejada *et al.* 2008), sorghum (Gutiérrez *et al.* 2008), and strawberries (Singh , 2010).

Conclusion

This experiment concluded that Carolea Olive variety attained the highest values in stem diameter, root dry weight, stem fresh weight, stem dry weight, leaf fresh weight, leaf dry weight, shoot fresh weight, shoot dry weight growth parameters while Frontoio Olive variety attained the best in roots fresh weight, and chlorophyll contents under salinity plus humic acid, Biozote and Vermicompost. Leaf area was the highest in Nocellera olive variety in salinity plus humic acid, Biozote and Vermicompost treatments.

Table1; Impact of brackish water on stem diameter, stem fresh weight, stem dry weight, Root fresh weight and Root dry weight of olive plants

Treatments	Stem Diameter (mm)				Stem Fresh Weight(g)				Stem Dry Weight(g)				Root Fresh Weight(g)				Root Dry Weight(g)			
	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M
T1	4.38	5.33	5.67	5.12	3.48	3.98	4.31	3.92	1.40	1.46	1.58	1.48	0.53	0.60	0.71	0.61	0.10	0.13	0.19	0.14
T2	6.64	6.77	6.52	6.64	7.43	8.10	8.89	8.14	3.46	3.73	5.27	4.15	0.64	0.67	0.59	0.63	0.17	0.15	0.12	0.14
T3	4.75	8.16	4.86	5.92	4.10	5.78	6.54	5.47	1.58	1.96	5.76	3.1	0.34	1.21	0.31	0.62	0.09	0.45	0.08	0.10
T4	3.98	7.34	8.10	6.47	3.10	4.34	5.23	4.22	1.19	1.38	1.68	1.41	0.29	1.01	1.19	0.83	0.06	0.31	1.11	0.49
T5	6.35	10.34	6.21	7.63	7.63	8.32	9.67	8.54	3.43	3.88	4.16	3.82	0.76	1.31	0.80	0.95	0.21	0.52	0.34	0.35
T6	8.06	8.34	7.56	7.98	9.35	9.76	10.34	9.81	4.98	5.13	5.39	5.16	1.17	1.21	1.01	1.52	0.44	0.30	0.38	0.37
T7	7.89	9.36	6.99	8.08	6.39	7.22	8.02	7.21	5.12	5.42	5.51	5.35	1.05	1.28	0.83	1.05	0.36	0.27	0.31	0.31

V1= Nocellera V2= Frontoio V3 = Carloea M = Mean

Table2; Impact of brackish water on leaf fresh weight, leaf dry weight, Shoot fresh weight, Shoot dry weight, Chlorophyll contents and leaf area of olive plants

Treatments	Leaf Fresh Weight(g)				Leaf Dry Weight(g)				Shoot Fresh Weight(g)				Shoot Dry Weight(g)				Chlorophyll Contents (%)				Leaf Area Cm^2)			
	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M	V1	V2	V3	M
T1	1.67	1.83	1.97	1.82	0.59	0.64	0.71	0.64	0.39	0.51	0.67	0.52	0.16	0.23	0.29	0.22	55.9	62.0	61.7	55.9	27.90	19.76	25.17	27.903
T2	2.78	3.06	3.32	3.05	0.89	0.94	1.03	0.95	0.66	0.80	1.03	0.83	0.27	0.35	0.43	0.35	53.6	49.5	46.5	53.6	21.32	23.66	21.39	21.321
T3	1.76	2.15	2.64	2.18	0.49	0.57	0.63	0.56	0.74	0.93	1.14	0.93	0.34	0.42	0.53	0.43	80.6	62.1	68.2	80.6	31.79	30.90	32.67	31.792
T4	1.13	1.77	1.88	1.59	0.29	0.41	0.55	0.41	0.79	1.03	1.19	1.00	0.39	0.47	0.57	0.47	74.3	78.2	61.3	74.3	20.88	28.23	19.76	20.881
T5	2.98	3.27	4.04	3.43	0.81	0.94	1.07	0.94	0.53	0.79	0.98	0.76	0.24	0.32	0.42	0.32	46.5	58.7	68.1	46.5	28.10	19.15	16.24	28.103
T6	2.17	2.34	2.67	2.39	0.78	0.81	0.97	0.85	0.49	0.69	0.93	0.70	0.20	0.28	0.39	0.29	68.2	54.5	70.3	68.2	18.17	23..8 0	19.78	18.167
T7	1.15	1.60	1.67	1.47	0.32	0.38	0.47	0.39	0.63	0.76	0.97	0.78	0.29	0.37	0.43	0.36	55.9	62.0	61.7	55.9	26.76	22.99	24.55	26.77

V1= Nocellera V2= Frontoio V3 = Carloea M = Mean

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