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Olive-mill and grape-mill waste as a substitute growing

medium component for unexplode vegetables

production in nurseries

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Introduction

Oliveculture and grape-vines production are the main crops in Mediterranean basin and in several other places all over the world.

Intensive crop production is revealing high yields but also great amount of wastes being of environmental and human health concern.

Olive mill waste, including olive leaves, pulp, and stones and also olive mill wastewater present great organic load and high phenolic components with phytotoxic effects and also great amounts of nutrients (K, N, P, Ca, Mg, Fe).

Wine industry produces increasing amount of liquid and solid wastes, whose management and disposal pose environmental difficulties due to both the seasonal nature and polluting attributes of these residues.

Introduction

Chemica Under nursery and greenh principal constituent of med production of young and pott

Approximately 14-20% of extra sector.

Due to high cost of peat extra constrains (greenhouse gases peat are examined.

- Olive mill wastes •
- Grapes mill waste •
- Paper waste •
- Compost
- Biochar •
- Sawdust •
- Coffee waste •
- Citrus peel waste
- Bark •
- Sewage sludge

Journal of Enviro R Journal homepage: ww rticle al characterization of biochar	a available at ScienceDirect ronmental Management www.elsevier.com/locate/jenvman	•
	Journal of Plant Nutrition Publication details, including instructions for authors and subscription information: http://www.tandfenine.com/ioi/ipla20 Deployment of Sawdust as Substrate Medium in Hydroponically Grown	IS the Journal of Soil Science and Plant Nutrition, 2015, 15 (1), 11-23 RESEARCH ARTICLE Municipal solid wastes and mineral fertilizer as an eggplant transplant medium
icted pe	Plant Nutrient Availability and pH of Biochars Their Fractions, with the Possible Use as a Component in a Growing Media Muno Prasal ^{1,2,*} , Antonios Chrysrgrif ³ , Nicola McDaniel ³ , Anna Kavanagh ³ , Biochar Type	A. Chrysargyris ¹ , N. Tzortzakis ^{2*}
-	transportation and el Seedling Prod	luction Munoo Prasad 123, Anna Kavanagh ³ and Nikos Tzortzakis 1.*
<u>ELSE</u> A bio	Alternative soilless media orefinery for conversion of citrus peel waste into essential	a using olive-mill and paper waste for growing
Maria I Envi	In, fertilizer and succinic acid via different fermentation standown and standown and succinic acid via different fermentation standown and succinic acid via different fermentation standown and succinic acid via different fermion standown and s	NAL PAPER Nation of Municipal Solid Waste Compost and/or Fertigation at Substituent for Pepper Seedlings Production
co	eployment of olive-stone waste as a substitute growing medium omponent for <i>Brassica</i> seedling production in nurseries	Migs. 766.org/13 1007/s1009-018-1547-7 ORIGINAL PAPER
1	WASTE AND BIOMASS MANAGEMENT & VALORIZATION The use of spent coffee grounds in growing media for the production of <i>Brassica</i> seedlings in nurseries	RESEARCH Substitution of peat with municipal solid waste compost in watermelon seedling production combined with fertigation Maria Papamichalaki ¹ , Anastasia Papadaki ¹ , and Nikos Tzortzakis ²⁺
1	Antonios Chrysargyris ¹ • Omiros Antoniou ¹ • Panayiota Xylia ¹ • Spyridon Petropoulos ² • Nikos Tzortzakis ¹ (2)	

Experimental layout

• Plant based waste:

olive-mill wastes (OMW) grape-mill wastes (GMW)

• Species:

Portulaca oleraceae (purslane) *Sonchus oleraceous* (sowthistle)

• System:

Pot culture

• Growing media:





OMW or GMW in different ratios (0-5-10-20-40% v/v) with peat

- Crop duration: 25 days
- Location: Greenhouse infrastructure at Cyprus University of Technology.

Experimental layout.....

Measurements:

- <u>Physicochemical properties of the growing media</u> (pH, EC, O.O., minerals (N, K, P, Na), total porosity, air filed porosity, bulk density etc).
- <u>Plant growth</u> (plant height, leaf number, fresh and dry plant weight).
- <u>Physiological</u> (chlorophylls, total carotenoids, leaf stomatal conductance, leaf fluorescence).
- Minerals (N, K, P, Ca, Mg with AAS and Kjeldahl).
- <u>Antioxidants</u> (polyphenols, flavonoids and antioxidant activity- FRAP, DPPH).
- <u>Damage index and antioxidant enzymes</u> (H₂O₂, lipid peroxidation, SOD, CAT, APX).









Portulaca oleraceae

Olive Mill Waste-OMW



	Peat 100%	OMW 5%	OMW 10%	OMW 20%	OMW 40%	OMW 100%
рН	<mark>6.43 c</mark>	6.59 bc	<mark>6.46 c</mark>	<mark>6.51 bc</mark>	<mark>6.73 a</mark>	6.57 b
EC (μS/cm)	<mark>209.65 e</mark>	226.10 e	290.30 d	350.40 c	<mark>612.25 b</mark>	1006.60 a
Organic matter (%)	94.14 bc	93.63 c	94.72 ab	94.57 ab	94.51 ab	95.15 a
N (g/kg)	6.73 b	7.41 ab	7.71 ab	7.64 ab	7.61 ab	<mark>8.19 a</mark>
K (g/kg)	1.51 e	2.41 d	2.74 d	3.43 c	<mark>4.01 b</mark>	<mark>6.23 a</mark>
P (g/kg)	<mark>0.93 a</mark>	0.84 b	0.82 bc	0.78 c	0.63 d	<mark>0.65 d</mark>
Na (g/kg)	0.34 a	0.32 ab	0.30 bc	0.31 b	0.27 d	0.28 de
Total porosity %	82.59 a	74.71 b	81.74 ab	75.84 b	74.79 b	80.40 ab
Air filled porosity (% v/v)	12.86 a	8.93 c	11.43 ab	6.61 d	5.36 d	8.00 bc
Bulk density (g/cm³)	0.18 e	0.18 e	0.22 d	0.24 c	<mark>0.35 b</mark>	<mark>0.50 a</mark>
Container capacity (% v/v)	69.73 a	65.78 a	70.32 a	69.24 a	69.43 a	70.40 a

Adding OMW \rightarrow EC, OO, N,K, bulk density

P, Na

Grape Mill Waste-GMW



	Peat 100%	GMW 5%	GMW 10%	GMW 20%	GMW 40%	GMW 100%
рН	<mark>6.43 e</mark>	6.59 d	6.89 c	7.10 b	<mark>7.40 a</mark>	7.19 b
EC (μS/cm)	209.65 c	230.90 c	265.15 c	351.65 b	388.40 b	767.05 a
Organic matter (%)	94.14 a	93.16 b	92.90 b	93.18 b	92.91 b	92.70 b
N (g/kg)	6.73 f	8.97 e	10.43 d	14.81 c	18.29 b	20.53 a
K (g/kg)	1.51 f	3.56 e	4.57 d	5.79 c	6.75 b	9.86 a
P (g/kg)	0.93 d	1.36 bc	1.26 c	1.57 b	<mark>2.10 a</mark>	2.08 a
Na (g/kg)	0.34 a	0.34 a	0.31 b	0.27 c	0.21 d	0.13 e
Total porosity %	82.59 c	79.46 cd	77.83 d	75.88 d	87.81 b	99.59 a
Air filled porosity (% v/v)	<mark>12.86 c</mark>	9.29 d	8.75 d	14.11 bc	15.00 b	33.57 a
Bulk density (g/cm³)	0.18 d	0.19 d	0.19 d	<mark>0.21 c</mark>	0.24 b	0.34 a
Container capacity (% v/v)	69.73 ab	70.18 ab	69.08 ab	61.77 с	72.81 a	66.02 b

Adding GMW \rightarrow pH, EC, N,K, P, Porosity, air filled porosity, bulk density

00, Na

Portulaca oleraceae (purslane)



Portulaca oleraceae (purslane)

Sonchus oleraceous (sowthistle)







Portulaca oleraceae (purslane) *Sonchus oleraceous* (sowthistle) 1.2 1.2 4 GAE/g) Total phenols (mg GAE/g) Total phenols (mg GAE/g) phenols (mg GAE/g) 0.9 0.9 3 Total phenols (mg 2 0.6 0.6 2 d 0.3 0.3 1 Total 0.0 0 0.0 Peat 100% GMW 5% GMW 10% GMW 20% GMW 40% Peat 100% OMW 5% OMW 10% OMW 20% OMW 40% Peat 100% GMW 5% GMW 10% GMW 20% GMW 40% Peat 100% OMW 5% OMW 10% OMW 20% OMW 40% Treatments Treatments Treatments Treatments 5 1.0 1.0 DPPH mg trolox/g DPPH mg trolox/g DPPH mg trolox/g mg trolox/g 0.8 4 0.8 4 С 0.6 3 0.6 3 DPPH 0.4 0.4 2 2 0.2 0.2 1 0.0 0.0 0 0 Peat 100% GMW 5% GMW 10% GMW 20% GMW 40% Peat 100% GMW 5% GMW 10% GMW 20% GMW 40% Peat 100% OMW 5% OMW 10% OMW 20% OMW 40% Peat 100% OMW 5% OMW 10% OMW 20% OMW 40% Treatments Treatments Treatments Treatments 1.5 1.5 Flavonoids (mg rutin/g) Flavonoids (mg rutin/g) Flavonoids (mg rutin/g) (mg rutin/g) 1.2 1.2 bc 0.9 0.9 4 с 0.6 0.6 ds ы 2 ouo 0.3 0.3 0.0 0.0 Peat 100% GMW 5% GMW 10% GMW 20% GMW 40% Peat 100% GMW 5% GMW 10% GMW 20% GMW 40% Peat 100% OMW 5% OMW 10% OMW 20% OMW 40% Peat 100% OMW 5% OMW 10% OMW 20% OMW 40%

Treatments

Treatments

Treatments

Treatments

Portulaca oleraceae (purslane)





Conclusions:

In **Portulaca oleraceae**,

- ➤ GMW affected plant growth with more pronounced effects at the high ratio of 40%. Plant height, leaf number, plant biomass and chlorophyll content (SPAD) did not change at ≤20% GMW. Leaf stomatal conductance decreased as the GMW ratio increased into the growing media.
- ➤ The application of OMW had similar effects as GMW with the high ratios of ≥ 20% to substantially decrease plant growth (height, number of leaves, fresh and dry weight) and physiological metabolism, with decreased chlorophyll content and leaf stomatal conductance.

In **Sonchus oleraceous**,

➤ The addition of GMW up to 10% stimulated or did not affect the plant height, number of leaves, fresh weight and chlorophylls. In contrast, OMW at ≥10% decreased plant growth. Leaf stomatal conductance was decreased proportionally with the increased ratios of GMW and OMW into the growing media.

Conclusions:

- The application of GMW and OMW affected to some extent the antioxidant activity, total phenolic content and total flavonoids in both species
- Both OMW and GMW provided mineral enrichment to the growing media which is of great importance regarding the fertilizers/mineral management during plant growth.
- Both GMW and OMW can be used in the growing media at low ratios of 10% and 5%, respectively.













Sonchus sp.

Portulaca oleracea L.

Thank you for your attention

Any questions?

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