

**IECHo
2022**

**1st International Electronic Conference
on Horticulturae**
16–30 April 2022 | ONLINE



horticulturae



CEBAS
CENTRO DE EDAFOLOGÍA Y
BIOLOGÍA APLICADA DEL SEGURA

CSIC
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS
CENTRO DE EDAFOLOGÍA Y BIOLOGÍA APLICADA DEL SEGURA

The effect of fertilization regime on growth parameters of *Sonchus oleraceus* and two genotypes of *Portulaca oleracea*

Ángel Carrascosa¹. José Antonio Pascual¹. Margarita Ros¹. Spiros A. Petropoulos². María del Mar Alguacil¹
*mmalguacil@cebas.csic.es

1 CEBAS-CSIC, Murcia, Spain

2 University of Thessaly, Volos, Greece

1. Introduction

Wild Edible Plants importance

- ✓ Relevant nutritional values
- ✓ Medicinal properties
- ✓ High adaptance and climate conditions
- ✓ Good candidates for soil regeneration



Portulaca oleracea. L.

1. Introduction

Wild Edible Plants importance

- ✓ Relevant nutritional values
- ✓ Medicinal properties
- ✓ High adaptance to soils and climate conditions
- ✓ Good candidates for soil regeneration



Sonchus oleraceus L.

1. Introduction

Cultivation of WEPs

- ✓ Wide use in traditional diets
- ✓ Generally unknown cultivation practices
- ✓ Potential benefits of their cultivation:
 - Cultivation of high added value species
 - Exploitation of degraded soils
 - Restoration of degraded soils



2. Materials and Methods

Cultivation in Greenhouse conditions

2. Materials and Methods

Cultivation in pot experiment at different fertilization regime in Greenhouse conditions



Sonchus oleraceus L.



Portulaca oleracea. L.

Both genotypes: From Spain and Greece

2. Materials and Methods

Fertilization applied weekly

Treatment	Fertilization
Control	No fertilization
IT1	NPK 100 - 100 - 100 ppm
IT2	NPK 300 - 100 - 100 ppm
IT3	NPK 600 - 100 - 100 ppm
IT4	NPK 300 - 200 - 100 ppm
IT5	NPK 300 - 300 - 100 ppm
IT6	NPK 300 - 200 - 200 ppm
IT7	NPK 300 - 300 - 300 ppm
OT1	NPK 300 - x - x ppm
OT2	NPK 300 - 200 - x ppm

Innorganic Treatment

Organic Treatment
(Compost extract)

✓ 3 Plants (Spanish and Greek purslane and sow-thistle)

✓ 9 Fertilization treatments + Control

✓ 4 Repetitions each

3. Results

Greek Purslane

Table 1. Effects on Greek purslane of nutritional treatments: Control, no fertilization applied; IT1, 100-100-100 ppm; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT5, 300-300-100 ppm; IT6, 300-200-200 ppm; IT7, 300-200-300 ppm; OT1, organic compost extracts (equivalent to 300 N ppm), OT2, organic compost extract + P inorg (equivalent to 300 N ppm – 200 P ppm) on leaves fresh and dry weight (LFW and LDW), shoots fresh and dry weight (SFW and SFW), and total aerial fresh and dry weight (TFW and TDW) of Greek purslane.

Treatment	LFW(g)	LDW(g)	SFW(g)	SDW(g)	TFW(g)	TDW(g)
Control	5.66 ± 0.69 a	0.48 ± 0.08 a	4.43 ± 1.59 a	0.4 ± 0.14 a	10.09 ± 1.92 a	0.88 ± 0.19 a
IT1	21.58 ± 2.35 bcd	1.79 ± 0.15 bc	20.36 ± 4.62 bc	1.72 ± 0.44 bcd	41.95 ± 3.31 bcd	3.51 ± 0.35 bc
IT2	28.53 ± 3.60 cde	2.43 ± 0.33 cd	29.03 ± 4.59 de	2.41 ± 0.67 cd	57.56 ± 7.24 de	4.84 ± 0.98 cd
IT3	42.12 ± 12.74 f	2.93 ± 0.68 d	40.24 ± 5.80 f	2.76 ± 0.67 d	82.36 ± 17.98 f	5.68 ± 1.31 d
IT4	31.99 ± 5.12 def	2.51 ± 0.60 cd	29.62 ± 3.89 de	2.27 ± 0.51 cd	61.61 ± 6.42 e	4.78 ± 1.07 cd
IT5	25.06 ± 3.17 bcde	2.09 ± 0.14 bcd	23.10 ± 2.71 cd	1.92 ± 0.47 bcd	48.15 ± 3.02 cde	4.00 ± 0.41 bcd
IT6	33.73 ± 4.02 ef	2.76 ± 0.46 d	30.78 ± 2.64 de	2.19 ± 0.54 bcd	64.50 ± 6.43 e	4.95 ± 0.98 cd
IT7	30.41 ± 1.54 def	2.61 ± 0.13 cd	32.13 ± 2.96 ef	2.69 ± 0.57 d	62.54 ± 2.08 e	5.30 ± 0.69 cd
OT1	15.98 ± 1.80 ab	1.41 ± 0.16 b	17.12 ± 3.23 bc	1.45 ± 0.25 abc	33.10 ± 3.63 bc	2.85 ± 0.38 b
OT2	17.21 ± 1.04 abc	1.5 ± 0.09 b	12.60 ± 1.04 ab	1.06 ± 0.11 ab	29.82 ± 1.70 b	2.56 ± 0.19 ab
ANOVA (F value P value)	18.26 (0.001)	18.61 (0.001)	34.86 (0.001)	9.79 (0.001)	34.99 (0.001)	15.53 (0.001)

3. Results

Greek Purslane

Table 1. Effects on Greek purslane of nutritional treatments: Control, no fertilization applied; IT1, 100-100-100 ppm; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT5, 300-300-100 ppm; IT6, 300-200-200 ppm; IT7, 300-200-300 ppm; OT1, organic compost extracts (equivalent to 300 N ppm), OT2, organic compost extract + P inorg (equivalent to 300 N ppm – 200 P ppm) on leaves fresh and dry weight (LFW and LDW), shoots fresh and dry weight (SFW and SFW), and total aerial fresh and dry weight (TFW and TDW) of Greek purslane.

Treatment	LFW(g)	LDW(g)	SFW(g)	SDW(g)	TFW(g)	TDW(g)
Control	5.66 ± 0.69 a	0.48 ± 0.08 a	4.43 ± 1.59 a	0.4 ± 0.14 a	10.09 ± 1.92 a	0.88 ± 0.19 a
IT1	21.58 ± 2.35 bcd	1.79 ± 0.15 bc	20.36 ± 4.62 bc	1.72 ± 0.44 bcd	41.95 ± 3.31 bcd	3.51 ± 0.35 bc
IT2	28.53 ± 3.60 cde	2.43 ± 0.33 cd	29.03 ± 4.59 de	2.41 ± 0.67 cd	57.56 ± 7.24 de	4.84 ± 0.98 cd
IT3	42.12 ± 12.74 f	2.93 ± 0.68 d	40.24 ± 5.80 f	2.76 ± 0.67 d	82.36 ± 17.98 f	5.68 ± 1.31 d
IT4	31.99 ± 5.12 def	2.51 ± 0.60 cd	29.62 ± 3.89 de	2.27 ± 0.51 cd	61.61 ± 6.42 e	4.78 ± 1.07 cd
IT5	25.06 ± 3.17 bcde	2.09 ± 0.14 bcd	23.10 ± 2.71 cd	1.92 ± 0.47 bcd	48.15 ± 3.02 cde	4.00 ± 0.41 bcd
IT6	33.73 ± 4.02 ef	2.76 ± 0.46 d	30.78 ± 2.64 de	2.19 ± 0.54 bcd	64.50 ± 6.43 e	4.95 ± 0.98 cd
IT7	30.41 ± 1.54 def	2.61 ± 0.13 cd	32.13 ± 2.96 ef	2.69 ± 0.57 d	62.54 ± 2.08 e	5.30 ± 0.69 cd
OT1	15.98 ± 1.80 ab	1.41 ± 0.16 b	17.12 ± 3.23 bc	1.45 ± 0.25 abc	33.10 ± 3.63 bc	2.85 ± 0.38 b
OT2	17.21 ± 1.04 abc	1.5 ± 0.09 b	12.60 ± 1.04 ab	1.06 ± 0.11 ab	29.82 ± 1.70 b	2.56 ± 0.19 ab
ANOVA (F value (P value)	18.26 (0.001)	18.61 (0.001)	34.86 (0.001)	9.79 (0.001)	34.99 (0.001)	15.53 (0.001)

3. Results

Spanish purslane

Table 2. Effects on Spanish purslane of nutritional treatments: Control, no fertilization applied; IT1, 100-100-100 ppm; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT5, 300-300-100 ppm; IT6, 300-200-200 ppm; IT7, 300-200-300 ppm; OT1, organic compost extracts (equivalent to 300 N ppm), OT2, organic compost extract + P inorg (equivalent to 300 N ppm – 200 P ppm) on leaves fresh and dry weight (LFW and LDW), shoots fresh and dry weight (SFW and SDW), and total aerial fresh and dry weight (TFW and TDW).

Treatment	LFW(g)	LDW(g)	SFW(g)	SDW(g)	TFW(g)	TDW(g)
Control	4.08 ± 0.60 a	0.17 ± 0.04 a	5.63 ± 0.48 a	0.54 ± 0.07 a	9.72 ± 0.41 a	0.71 ± 0.07 a
IT1	15.24 ± 1.63 bc	0.98 ± 0.08 bc	25.83 ± 2.92 bcd	2.34 ± 0.29 bc	41.07 ± 3.51 bcd	3.32 ± 0.27 bcd
IT2	21.08 ± 2.44 cd	1.36 ± 0.37 cd	29.75 ± 3.83 cd	2.32 ± 0.55 bc	50.84 ± 5.68 cd	3.68 ± 0.80 bcd
IT3	36.01 ± 2.11 f	2.10 ± 0.14 e	44.92 ± 5.51 e	3.12 ± 0.68 c	80.93 ± 7.34 e	5.22 ± 0.69 e
IT4	23.90 ± 3.62 d	1.47 ± 0.17 cd	38.77 ± 8.13 de	3.09 ± 0.54 c	62.65 ± 11.69 d	4.55 ± 0.68 de
IT5	90.00 ± 3.13 cd	1.08 ± 0.42 bcd	29.10 ± 9.7 cd	2.22 ± 1.10 bc	48.08 ± 11.57 cd	3.30 ± 1.42 bcd
IT6	21.59 ± 4.46 d	1.05 ± 0.20 bcd	33.9 ± 3.60 de	2.62 ± 0.53 bc	55.54 ± 7.26 cd	3.67 ± 0.66 bcd
IT7	20.93 ± 1.76 cd	1.52 ± 0.13 d	33.00 ± 6.71 de	2.66 ± 0.78 bc	54.00 ± 6.33 cd	4.18 ± 0.70 cde
OT1	10.26 ± 1.27 ab	0.78 ± 0.08 b	18.40 ± 0.96 abc	1.82 ± 0.16 ab	28.66 ± 1.46 bc	2.60 ± 0.20 b
OT2	9.43 ± 2.22 ab	0.62 ± 0.16 ab	14.71 ± 5.55 ab	1.35 ± 0.50 ab	24.14 ± 7.75 b	1.97 ± 0.63 ab
ANOVA (F value (P value)	48.81 (0.001)	25.56 (0.001)	18.08 (0.001)	7.07 (0.001)	32.19 (0.001)	10.12 (0.001)

3. Results

Spanish Purslane

Table 2. Effects on Spanish purslane of nutritional treatments: Control, no fertilization applied; IT1, 100-100-100 ppm; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT5, 300-300-100 ppm; IT6, 300-200-200 ppm; IT7, 300-200-300 ppm; OT1, organic compost extracts (equivalent to 300 N ppm), OT2, organic compost extract + P inorg (equivalent to 300 N ppm – 200 P ppm) on leaves fresh and dry weight (LFW and LDW), shoots fresh and dry weight (SFW and SFW), and total aerial fresh and dry weight (TFW and TDW).

Treatment	LFW(g)	LDW(g)	SFW(g)	SDW(g)	TFW(g)	TDW(g)
Control	4.08 ± 0.60 a	0.17 ± 0.04 a	5.63 ± 0.48 a	0.54 ± 0.07 a	9.72 ± 0.41 a	0.71 ± 0.07 a
IT1	15.24 ± 1.63 bc	0.98 ± 0.08 bc	25.83 ± 2.92 bcd	2.34 ± 0.29 bc	41.07 ± 3.51 bcd	3.32 ± 0.27 bcd
IT2	21.08 ± 2.44 cd	1.36 ± 0.37 cd	29.75 ± 3.83 cd	2.32 ± 0.55 bc	50.84 ± 5.68 cd	3.68 ± 0.80 bcd
IT3	36.01 ± 2.11 f	2.10 ± 0.14 e	44.92 ± 5.51 e	3.12 ± 0.68 c	80.93 ± 7.34 e	5.22 ± 0.69 e
IT4	23.90 ± 3.62 d	1.47 ± 0.17 cd	38.77 ± 8.13 de	3.09 ± 0.54 c	62.65 ± 11.69 d	4.55 ± 0.68 de
IT5	90.00 ± 3.13 cd	1.08 ± 0.42 bcd	29.10 ± 9.7 cd	2.22 ± 1.10 bc	48.08 ± 11.57 cd	3.30 ± 1.42 bcd
IT6	21.59 ± 4.46 d	1.05 ± 0.20 bcd	33.9 ± 3.60 de	2.62 ± 0.53 bc	55.54 ± 7.26 cd	3.67 ± 0.66 bcd
IT7	20.93 ± 1.76 cd	1.52 ± 0.13 d	33.00 ± 6.71 de	2.66 ± 0.78 bc	54.00 ± 6.33 cd	4.18 ± 0.70 cde
OT1	10.26 ± 1.27 ab	0.78 ± 0.08 b	18.40 ± 0.96 abc	1.82 ± 0.16 ab	28.66 ± 1.46 bc	2.60 ± 0.20 b
OT2	9.43 ± 2.22 ab	0.62 ± 0.16 ab	14.71 ± 5.55 ab	1.35 ± 0.50 ab	24.14 ± 7.75 b	1.97 ± 0.63 ab
ANOVA (F value (P value)	48.81 (0.001)	25.56 (0.001)	18.08 (0.001)	7.07 (0.001)	32.19 (0.001)	13.44 (0.001)

3. Results

Sow-thistle

Table 3. Effects on sow-thistle of nutritional treatments: Control, no fertilization applied; IT1, 100-100-100 ppm; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT5, 300-300-100 ppm; IT6, 300-200-200 ppm; IT7, 300-200-300 ppm; OT1, organic compost extracts (equivalent to 300 N ppm), OT2, organic compost extract + P inorg (equivalent to 300 N ppm – 200 P ppm) on leaves fresh weight (LFW), shoots fresh weight (SFW), and total aerial fresh (TFW).

Treatment	LFW (g)	SFW(g)	TFW(g)
Control	1.85 ± 1.39 a	5.04 ± 3.07 a	6.88 ± 4.45 a
IT1	12.07 ± 2.72 b	14.67 ± 4.19 ab	26.74 ± 4.84 b
IT2	31.05 ± 1.07 d	22.71 ± 5.54 bcd	53.76 ± 5.72 cd
IT3	39.16 ± 5.93 e	34.39 ± 6.44 e	73.55 ± 11.47 e
IT4	25.10 ± 0.83 cd	29.06 ± 2.57 cde	54.16 ± 3.12 cd
IT5	28.33 ± 3.71 cd	25.69 ± 4.21 bcde	54.01 ± 2.58 cd
IT6	24.65 ± 3.10 cd	27.52 ± 4.69 cde	52.17 ± 7.24 cd
IT7	28.17 ± 2.75 cd	31.97 ± 0.92 de	60.14 ± 2.23 de
OT1	23.09 ± 3.35 c	20.24 ± 4.06 bc	43.33 ± 4.75 c
OT2	22.76 ± 3.47 c	22.92 ± 7.26 bcd	45.68 ± 5.39 c
ANOVA (F value (P value)	42.09 (<0.001)	13.88 (<0.001)	41.18 (<0.001)

3. Results

Sow-thistle

Table 3. Effects on sow-thistle of nutritional treatments: Control, no fertilization applied; IT1, 100-100-100 ppm; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT5, 300-300-100 ppm; IT6, 300-200-200 ppm; IT7, 300-200-300 ppm; OT1, organic compost extracts (equivalent to 300 N ppm), OT2, organic compost extract + P inorg (equivalent to 300 N ppm – 200 P ppm) on leaves fresh weight (LFW), shoots fresh weight (SFW), and total aerial fresh (TFW).

Treatment	LFW (g)	SFW(g)	TFW(g)
Control	1.85 ± 1.39 a	5.04 ± 3.07 a	6.88 ± 4.45 a
IT1	12.07 ± 2.72 b	14.67 ± 4.19 ab	26.74 ± 4.84 b
IT2	31.05 ± 1.07 d	22.71 ± 5.54 bcd	53.76 ± 5.72 cd
IT3	39.16 ± 5.93 e	34.39 ± 6.44 e	73.55 ± 11.47 e
IT4	25.10 ± 0.83 cd	29.06 ± 2.57 cde	54.16 ± 3.12 cd
IT5	28.33 ± 3.71 cd	25.69 ± 4.21 bcde	54.01 ± 2.58 cd
IT6	24.65 ± 3.10 cd	27.52 ± 4.69 cde	52.17 ± 7.24 cd
IT7	28.17 ± 2.75 cd	31.97 ± 0.92 de	60.14 ± 2.23 de
OT1	23.09 ± 3.35 c	20.24 ± 4.06 bc	43.33 ± 4.75 c
OT2	22.76 ± 3.47 c	22.92 ± 7.26 bcd	45.68 ± 5.39 c
ANOVA (F value (P value)	42.09 (<0.001)	13.88 (<0.001)	41.18 (<0.001)

3. Results

Table 4. Effects on Greek purslane total leaves nutrient content of nutritional treatments: Control, no fertilization applied; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT6, 300-200-200 ppm; OT1, organic compost extracts (equivalent to 300 N ppm) on leaves nutrient content: C (Carbon g/Kg), N (Nitrogen g/Kg), P (Phosphorous g/Kg) and K (Potassium g/Kg)

Treatment	C (g/Kg)	N (g/Kg)	P (g/Kg)	K (g/Kg)
Control	346.9 ± 6.4 a	10.9 ± 0.8 a	13.2 ± 1.3 c	41.1 ± 3
IT2	359.4 ± 7.5 b	16 ± 1.6 ab	4 ± 1.1 ab	40.5 ± 7.1
IT3	385.4 ± 5.9 c	29.9 ± 6.9 c	2.7 ± 0.4 a	36.1 ± 2.1
IT4	366.7 ± 0.8 b	18.6 ± 4.2 ab	5.3 ± 2.6 ab	41.3 ± 7.5
IT6	368.6 ± 3.2 b	19.2 ± 3.4 b	5.3 ± 1 ab	40.1 ± 4.9
OT1	357.3 ± 4.7 ab	15 ± 1 ab	5.8 ± 0.9 b	42.3 ± 7.1
ANOVA (F value (P value)	24.49 (<0.001)	12.47 (<0.001)	28.57 (<0.001)	0.58 (<0.72)

3. Results

Table 5. Effects on Greek purslane total leaves nutrient content of nutritional treatments: Control, no fertilization applied; IT2, 300-100-100 ppm; IT3, 600-100-100 ppm; IT4, 300-200-100 ppm; IT6, 300-200-200 ppm; OT1, organic compost extracts (equivalent to 300 N ppm) on leaves nutrient content: K (Potassium g/Kg), Mg (Magnesium g/Kg), Fe (Iron g/Kg), Ca (Calcium g/Kg) and S (Sulfur g/Kg).

Treatment	Mg (g/Kg)	Fe(g/Kg)	Ca (g/Kg)	S (g/Kg)
Control	7.7 ± 3.7 b	0.059 ± 0.026	9.30 ± 4.2 b	0.9 ± 0.1 a
IT2	4.2 ± 0.5 ab	0.061 ± 0.040	4.7 ± 1.1 a	1.9 ± 0.8 ab
IT3	3.56 ± 0.2 a	0.011 ± 0.054	4.7 ± 0.4 a	2.6 ± 0.4 b
IT4	3.5 ± 0.07 a	0.073 ± 0.036	4.3 ± 0.37 a	1.9 ± 0.6 ab
IT6	3.1 ± 0.3 a	0.045 ± 0.050	3.8 ± 0.6 a	2 ± 0.5 ab
OT1	3.5 ± 0.5 a	0.061 ± 0.027	4.3 ± 0.6 a	1.5 ± 0.4 ab
ANOVA (F value (P value)	4.99 (0.005)	1.60 (0.20)	5.02 (0.005)	4.83 (<0.05)

Conclusions

- ✓ The application of both inorganic and organic fertilization promoted growth in both WEPs
- ✓ The response to nutrient demand differed between species: Purslane only showed high response to nitrogen. Sow-thistle also showed high response to potassium and compost extract.



THANK YOU FOR YOUR ATTENTION