# Compost Mixes as Substrates for Seedling Production

Mário Reis and Luísa Coelho
Universidade do Algarve, Faculdade de Engenharia de Recursos Naturais
Campus de Gambelas, 8005-139 Faro, Portugal

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**Abstract**[1]

**Composts were mixed with peat, to prepare substrates for the production of vegetable seedlings. Sewage sludge, municipal solid waste and yard prunings, were mixed in the proportions (v/v) of 1:0:3 (compost A); 0:1:1.5 (compost B) and 1:1:2 (compost C) and composted in windrows. Composts were sieved (<4mm) and mixed with a commercial peat mix for nurseries (Pindstrup Plus, Pindstrup Rosebrug A/S, Denmark) in percentages ranging from 20 to 60% (v/v). Prepared mixes were used in polystyrene seedling trays of 15 and 18 $cm^3$ (242 and 338 plants per tray). The incorporation of a physical soil conditioner with hydroabsorbent polymers (Terracottem®, Belgium, 5 $gL^{-1}$) in the substrate was also tested. Composts and their mixes were chemically and physically characterized. Tested vegetable species were: *Lycopersicon esculentum* Mill. L., *Capsicum annuum* L. and *Brassica oleracea* L. Trials were conducted in a commercial nursery (Viveiros Vida Verde, Faro, Portugal), during 2002 and 2003, in a greenhouse with automatic (micro sprinklers) and manual irrigation. Tested composts showed no remarkable differences among them and were able to replace peat in mixes for seedling trays up to 60% (v/v) on cabbage, and 40% on tomato and pepper, sometimes with increased seedling growth. However, the extraction of plants from the seedling trays may become more difficult. In some growing mixes, hydrogel increased seedling growth.**

**On tomato, the emergence of seedlings was not affected or it was reduced in compost mixes. When seed emergence was reduced, an increase in the number of days to achieve commercial size seedlings was observed. Hydrogel increased plant growth on commercial peat mix and on 30% compost mixes, but not on 20% mixes.**

**Pepper seedlings emergence was not affected and plant growth was increased with compost at 20% and 40% (v/v). Hydrogel increased plant growth on 20% compost mixes, but not on 40% mixes.**

**Cabbage seed germination was reduced on 60% compost mixes, but seedlings growth was increased. Hidrogel increased only some of the growth variables.**

## INTRODUCTION

Several materials have been tested in order to replace peat in horticulture, particularly in pot plant production (Raviv *et al*., 1986; Abad *et al*., 1993), including composted organic residues (Reis *et al*., 1997, Reis *et al*., 1993). However, a very good quality of these materials is required, due to the usual small volumes of substrate per plant (Zucconi and Bertoldi, 1987; Inbar *et al*., 1993).

[1] Proceedings do “International Symposium Protected Cultivation in Mild Winter Climates: Advances in Soil and Soilless Cultivation Under Protected Environemnt”, A. Hanafi & W.A. Scnitzler (edi.). Acta Horticulturae 747:283-291.

The objective of this research was to characterize and test composts made from residues of urban origin (sewage sludge, yard prunings and MSW) in substrate mixes for transplant production of tomato, pepper and cabbage.

## MATERIALS AND METHODS

Sewage sludge, municipal solid waste and yard prunings, were mixed in the proportions (v/v) of 1:0:3 (compost A); 0:1:1.5 (compost B) and 1:1:2 (compost C) and composted in windrows. Composts were sieved (< 4mm) and mixed with a commercial peat mix for nurseries (Pindstrup Plus, Pindstrup Rosebrug A/S, Denmark) to prepare substrates for the production of vegetable seedlings, in percentages ranging from 20 to 60% (v/v). Substrates were used in polystyrene seedling trays of 15 and 18 $cm^3$ (242 and 338 plants per tray). Trials were conducted in a commercial nursery (Viveiros Vida Verde, Faro, Portugal), during 2002 and 2003, in a plastic greenhouse with automatic (micro sprinklers) and manual irrigation (Table 1). Composts and their mixes were characterized (

Table 2). Electrical conductivity (EC), with a conductivimeter (Crison 522, Crison Instruments) in the pH extract (Martinez e Casasayas, 1988); pH, with a potentiometer (Crison 2001, Crison Instruments) in a 1:2 water extract of a 100 $cm^3$ volume sample measured under a pressure of 10 g $cm^{-2}$ (Martinez e Casasayas, 1988); volatile solids (VS) by calcination of milled dry sample at 560ºC for 3 h (Ramos *et al.*, 1987). Total pore space (TPS), air capacity (AC), easily available water (EAW), water buffering capacity (WBC), difficult available water (DAW) and the total water (TW) were determined according to De Boodt *et al.* (1974) method. Particle density was determined from the organic matter and ashes content (Martinez, 1992). Bulk density was determined following an adaptation of Boodt *et al.* (1974), consisting in the determination of the water content of the material by weighing the cylinder with the material at saturation equilibrium and after drying at 105 ºC. Volume contraction (CTR) was calculated from the contraction of substrates in the cylinders for bulk density, after drying at 105 ºC. A physical soil conditioner with hydroabsorbent polymers, NPK fertilizers and trace elements (Terracottem®, Belgium) was tested at 5 $gL^{-1}$. Tested vegetable species were: *Lycopersicon esculentum* Mill. L., *Capsicum annuum* L. and *Brassica oleracea* L (Table 1). Plants were evaluated by measuring: steam diameter (D), plant height (H), fresh and dry weight of canopy (FWA, DWA) and calculating the dry matter content (DMA). Results were analysed by ANOVA and Duncan's test with SPSS® software.

## RESULTS AND DISCUSSION

### Tomato

Germination was reduced in the early stages accordingly to the amount of compost in the mixes. By the end of the trials there were no differences in the germination % (

Table 3). However, that delay in germination contributed to the reduced final plant size accordingly to the % of compost in the substrate, namely in the 1$^{st}$ trial (Table 4). In the 2$^{nd}$ trial the delay in germination was shorter, and on the contrary, up to 30% (v/v) compost increased plant growth (Table 4). Compost B showed a better performance in the 1$^{st}$ year, but in the 2$^{nd}$ year this was achieved by compost A (Table 6). When compost is used, the substrate "block" can easily break when is removed from the seedling tray. This ocurrred in the 1$^{st}$ year but not in the 2$^{nd}$ one (Table 7).

### Cabbage

Composts B and C reduced germination in the 1$^{st}$ trial but not in the 2$^{nd}$ (Table 8).

Compost in the mix up to 60% promoted identical (1st trial) or better growth (1st and 2nd trials) than in peat (

Table 11). Composts performance in the 1st trial was more similar, than in the 2nd trial, in which compost A induced higher plants but with less dry matter %. Composts B and C produced smaller plants but with higher dry matter % (Table 10).
Globally, the higher compost percentage (60%) promoted plant growth (Table 9). Composts did not reduce the "extraction" of the seedlings from the trays in the 1st trial, but in the 2nd trial this was more difficult in the mixes with composts A and B (Table 12).

**Pepper**

Compost did not reduce germination (Table 13) and increased plant growth (

Table 15). No differences were observed between composts (

Table 14). In both trials, compost up to 40% produced identical plant growth, although with a lower dry matter content in the 1st trial, and higher in the 2nd one (Table 16). Compost reduced the extraction of the plants in the 2nd trial (Table 17).

**Hidrogel**

Hidrogel had not effect on seed germination. Hidrogel increased tomato growth in peat, and in 30% compost mixes, while pepper growth was increased in peat and in 20% mixes, but not in 40% mixes. There was no clear increase of cabbage seedlings growth, just greater steam diameter and height in 30% and 60% mixes, and fresh and dry weight in 30% mixes. In the mixes with hidrogel pepper transplants were more difficult to extract, but tomato and cabbage where not affected.

**Compost mixes properties**

Substrate pH kept between normal and slightly high for plant growing (Table 2), but CE reached relatively high values, that may affect seed germination. Globally, mixing more than 40% (v/v) of compost in the substrate reduced total pore space to less than 80%, decreasing air capacity but increasing the easily available water of the mixes, without noticeable variations in water buffering capacity and difficult available water.

## CONCLUSIONS

Compost mix with peat up to 40% (v/v) improved some physical properties, namely the easily available water of the mixes, keeping total pore space above 80%, but decreasing air capacity. Composts could replace 30 to 60% peat, in volume, in the substrates, accordingly to the specie. However, compost in the substrates for seedling trays may turn more difficult the extraction of the plants from the trays: the "block" of substrate was more easily broken than when peat was used, due to the structure of the substrate, its low volume and the small root development at this growth stage. This problem was also related to the water content of the substrate at the end of the nursery period. For these reason the tested composts mixes seem more adequate as substrates to be used in other type of containers such as pots, namely on open air, due to their increased bulk density and water retention capacity.

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## Tables

Table 1. General characterization of the experiments.

| Culture | 1st (date, duration in days, cv.) | 2nd (date, duration in days, cv.) | volume |
|---|---|---|---|
| tomato | 9/4- 9/5/2002 -30 ‘Urânia’ | 27/5- 26/6/2003 - 30 ‘Coimbra’ | 15 mL |
| cabbage | 9/4- 15/5/2002 - 36 ‘Cape Horn’ | 27/5- 02/7/2003 - 36 ‘Cape Horn’ | 18 mL |
| pepper | 28/5- 16/6/2002 - 50 ‘Jupiter’ | 17/19- 29/12/2003 - 73 ‘Jupiter’ | 18 mL |

Table 2. Physical and chemical[1] properties of the tested mixes[1].

| | (% v/v) | pH | CE (dS/m) | VS (%w/w) | Particle density | Bulk density | TPS (%v/v) | CTR (%v/v) | AC (%v/v) | EAW (% v/v) | WBC (% v/v) | DAW (% v/v) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Peat | | 6.44 | 0.19 | 90.5 | 1.52 | 0.12 | 92.2 | 29.8 | 36.3 | 22.6 | 5.04 | 28.3 |
| compost A | 20 | 6.47 | 2.18 | 53.0 | 1.84 | 0.28 | 84.8 | 16.7 | 20.3 | 23.7 | 6.13 | 34.6 |
| | 30 | 6.28 | 2.55 | 43.9 | 1.94 | 0.33 | 83.3 | 10.7 | 26.1 | 26.6 | 5.45 | 25.1 |
| | 40 | 6.53 | 4.55 | 33.8 | 2.07 | 0.39 | 81.3 | 6.30 | 24.0 | 23.9 | 4.76 | 28.6 |
| | 60 | 6.42 | 3.60 | 30.0 | 2.12 | 0.48 | 77.3 | 0 | 27.2 | 17.5 | 3.90 | 28.8 |
| | 100 | 6.55 | 3.41 | 28.2 | 2.15 | 0.71 | 67.1 | 0 | 21.7 | 20.2 | 6.13 | 19.0 |
| compost B | 20 | 6.73 | 1.41 | 60.4 | 1.77 | 0.23 | 87.2 | 19.0 | 31.6 | 25.8 | 5.33 | 24.4 |
| | 30 | 6.94 | 2.67 | 50.3 | 1.87 | 0.29 | 84.8 | 8.01 | 25.8 | 26.7 | 6.36 | 25.9 |
| | 40 | 6.85 | 2.16 | 38.6 | 2.01 | 0.33 | 83.5 | 4.28 | 19.5 | 29.2 | 5.67 | 29.1 |
| | 60 | 7.09 | 4.13 | 33.3 | 2.08 | 0.34 | 83.8 | 0 | 35.1 | 20.6 | 4.18 | 23.9 |
| | 100 | 7.62 | 2.91 | 29.1 | 2.14 | 0.54 | 74.5 | 0 | 18.7 | 22.0 | 6.13 | 27.6 |
| compost C | 20 | 6.56 | 1.48 | 54.0 | 1.83 | 0.23 | 87.4 | 16.0 | 15.8 | 31.2 | 6.01 | 34.5 |
| | 30 | 5.81 | 3.18 | 32.1 | 2.09 | 0.33 | 84.5 | 10.8 | 26.4 | 24.3 | 4.52 | 29.3 |
| | 40 | 6.86 | 2.23 | 32.4 | 2.09 | 0.37 | 82.4 | 6.11 | 18.4 | 26.6 | 4.49 | 32.9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 60 | 6.35 | 2.37 | 28.2 | 2.15 | 0.46 | 78.5 | 0 | 22.8 | 20.9 | 3.55 | 31.3 |
| 100 | 6.98 | 4.01 | 24.0 | 2.21 | 0.65 | 70.6 | 0 | 14.9 | 20.1 | 3.89 | 31.6 |

[1] CE, electrical conductivity; DM, dry matter (%); VS, volatile solids (%); TPS, total pore space, CTR, volume contraction (%), AC, air capacity, EAW, easily available water, BC, water buffering capacity, DAW, difficult available water

Table 3. Tomato: germination percentage[1].

| Trial | Treatments (% of compost in the mix) | | | | | | |
|---|---|---|---|---|---|---|---|
| 1st | Peat | 20A | 40A | 20B | 40B | 20C | 40C |
| 30 days | 84.3b | 75.3b | 75.0b | 85.5a | 69.8b | 84.6a | 71.5b |
| 2nd | Peat | 20A | 30A | 20B | 30B | 20C | 30C |
| 30 days | 93.0abc | 88.3bc | 91.0abc | 92.5abc | 93.5abc | 90.5abc | 93.3abc |
| | PeatH | 20AH | 30AH | 20BH | 30BH | 20CH | 30CH |
| 30 days | 87.8c | 94.5ab | 93.8abc | 96.5a | 92.3abc | 89.0bc | 90.8abc |

[1] For each trial and in each line (nº of days): small letters for mean separation at 5% level (Duncan' Test).

Table 4. Tomato: mean values of the plant growth variables[2] at the end of the trials[1].

| Trial | Substrate | | D (mm) | H (cm) | FWA (g) | DWA (g) | DMA % |
|---|---|---|---|---|---|---|---|
| 1st | Peat | | 2.60a | 6.93a | 1.11a | 0.116a | 10.4a |
| | A | 30 | 1.75cd | 3.12d | 0.30d | 0.027e | 8.6b |
| | | 60 | 1.52e | 2.40e | 0.16e | 0.014e | 8.8b |
| | B | 30 | 2.38b | 5.60b | 0.95b | 0.095b | 10.2a |
| | | 60 | 1.70d | 2.81de | 0.25ed | 0.023e | 8.6b |
| | C | 30 | 1.87c | 3.65c | 0.46c | 0.043c | 9.1b |
| | | 60 | 1.60de | 2.49e | 0.21ed | 0.019e | 8.9b |
| 2nd | Peat | | 3.04b | 25.5de | 2.37c | 0.23c | 9.81bcd |
| | Peat H | | 3.08b | 27.6c | 2.61c | 0.23bc | 8.87de |
| | A | 20 | 3.28a | 30.7ab | 3.54a | 0.27abc | 7.46f |
| | | 30 | 3.07b | 32.2a | 3.08b | 0.26abc | 8.28ef |
| | | 20H | 3.11b | 31.9ab | 3.08b | 0.27ab | 8.77de |
| | | 30H | 3.41a | 31.9ab | 3.71a | 0.30a | 8.09ef |
| | B | 20 | 2.92bc | 27.7c | 2.50c | 0.25bc | 10.3abc |
| | | 30 | 2.75c | 35.4cd | 2.38c | 0.26abc | 11.4a |
| | | 20H | 2.82c | 27.9c | 2.39c | 0.25bc | 10.4ab |
| | | 30H | 3.06b | 31.4ab | 3.00b | 0.27abc | 8.91de |
| | C | 20 | 3.02b | 27.7c | 2.63c | 0.25bc | 9.61bcd |
| | | 30 | 3.09b | 31.1ab | 3.04b | 0.27ab | 9.22cde |
| | | 20H | 2.93bc | 24.3e | 2.34c | 0.24bc | 10.4ab |
| | | 30H | 3.02b | 30.1b | 2.98c | 0.26abc | 8.69de |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 5. Tomato: comparison of the percentage of the compost in the mix[1].

| Trial | Compost (%) | D[2] (mm) | H (cm) | FWA (g) | DWA (g) | DMA % |
|---|---|---|---|---|---|---|
| 1st | 0 (peat) | 2.60a | 6.93a | 1.11a | 0.116a | 10.4a |
| | 30 | 2.00b | 4.10b | 0.566b | 0.545b | 9.2b |
| | 60 | 1.60c | 2.56c | 0.203c | 0.183c | 8.8c |
| 2nd | 0 (peat) | 3.04bc | 25.5e | 2.38d | 0.23c | 9.81a |
| | 0H | 3.07ab | 27.6d | 2.59c | 0.23c | 8.90c |
| | 20 | 3.07ab | 28.7c | 2.89b | 0.26b | 9.13bc |
| | 20H | 2.95c | 28.0cd | 2.60c | 0.25b | 9.84a |
| | 30 | 2.97bc | 29.9b | 2.83b | 0.26ab | 9.64ab |
| | 30H | 3.16a | 31.1a | 3.23a | 0.28a | 8.56c |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 6. Tomato: comparison of composts[1].

| Trial | Compost | $D^2$ (mm) | H (cm) | FWA (g) | DWA (g) | % DMA |
|---|---|---|---|---|---|---|
| 1st | A | 1.95b | 4.13b | 0.521b | 0.518b | 9.24b |
| | B | 2.23a | 5.11a | 0.769a | 0.782a | 9.74a |
| | C | 2.02b | 4.35b | 0.769b | 0.592b | 9.47b |
| 2nd | A | 3.16a | 30.0a | 3.07a | 0.259a | 8.55c |
| | B | 2.94c | 27.7b | 2.54c | 0.247a | 9.96a |
| | C | 3.03b | 27.7b | 2.66b | 0.248a | 9.44b |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 7. Tomato: percentage of "extractable" plants[1].

| Trial | Treatments (% of compost in the mix) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1st | Peat | | 30A | 60A | 30B | 60B | 30C | 60C |
| | 95.3a | | 49.3bc | 17.5d | 72.0ab | 47.0bcd | 56.8bc | 37.5cd |
| 2nd | Peat | PeatH | 20A | 30A | 20B | 30B | 20C | 30C |
| | 40.8abc | 25.5bc | 67.8a | 59.5ab | 28.0bc | 51.0abc | 64.0a | 49.3abc |
| | | | 20AH | 30AH | 20BH | 30BH | 20CH | 30CH |
| | | | 48.5abc | 52.8abc | 27.8bc | 40.5abc | 23.5 c | 60.5ab |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).

Table 8. Cabbage: germination percentage[1].

| Trial | Treatments (% of compost in the mix) | | | | | | |
|---|---|---|---|---|---|---|---|
| 1st | Peat | 20A | 40A | 20B | 40B | 20C | 40C |
| 30 days | 98.8ab | 98ab | 82.8abc | 98ab | 76.3c | 99.3a | 80.5bc |
| 2nd | T | 30A | 60A | 30B | 60B | 30C | 60C |
| 30 days | 93.0a | 95.0a | 95.5a | 96.0a | 94.3a | 93.3a | 93.8a |
| | TH | 30AH | 60AH | 30BH | 60BH | 30CH | 60CH |
| 30 days | 93.0a | 93.0a | 93.8a | 94.5a | 94.3a | 97.0a | 95.0a |

[1] For each trial and in each line (nº of days): small letters for mean separation at 5% level (Duncan' Test).

Table 9. Cabbage: comparison of the percentage of the compost in the mix [1].

| Trial | Compost (%) | $D^2$ (mm) | H (cm) | FWA (g) | DWA (g) | DMA % |
|---|---|---|---|---|---|---|
| 1st | 0 (peat) | 3.03ab | 4.52b | 3.37a | 0.32a | 9.54a |
| | 30 | 2.97c | 5.36a | 3.39b | 0.28a | 8.17b |
| | 60 | 3.08a | 3.91c | 3.44a | 0.34a | 9.7a |
| 2nd | 0 (peat) | 2.16d | 4.88f | 2.20d | 0.23c | 10.5ab |
| | 0H | 2.44c | 5.84e | 2.52c | 0.26c | 10.2b |
| | 30 | 2.88ab | 7.96d | 3.57b | 0.38b | 10.8a |
| | 30H | 2.92ab | 8.97b | 3.95a | 0.41a | 10.6ab |
| | 60 | 2.87b | 8.51c | 3.94a | 0.42a | 10.8a |
| | 60H | 2.95a | 9.91a | 4.09a | 0.41a | 10.2b |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 10. Cabbage: comparison of composts[1].

| Trial | Compost | $D^2$ (mm) | H (cm) | FWA (g) | DWA (g) | % DMA |
|---|---|---|---|---|---|---|
| 1st | A | 3.09a | 4.85a | 3.52a | 0.32a | 8.85a |
| | B | 2.95b | 4.51ab | 3.29a | 0.31a | 9.21a |
| | C | 3.04ab | 4.43b | 3.4a | 0.32a | 9.35a |
| 2nd | A | 2.69b | 8.27a | 3.45a | 0.34a | 10.1b |
| | B | 2.67b | 7.23b | 3.23b | 0.35a | 10.8a |

| | C | 2.74a | 7.54b | 3.45a | 0.36a | 10.6a |
|---|---|---|---|---|---|---|

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA canopy fresh weight, DWA canopy dry weight; DMA, dry matter.

Table 11. Cabbage: mean values of the plant growth variables[2] at the end of the trials[1].

| Trial | Substrate | | D (mm) | H (cm) | FWA (g) | DWA (g) | DMA % |
|---|---|---|---|---|---|---|---|
| 1st | Peat | | 3.03bc | 4.52c | 3.37ab | 0.32abc | 9.54ab |
| | A | 30 | 3.03bc | 6.22a | 3.54ab | 0.26d | 7.28d |
| | | 60 | 3.21a | 3.82d | 3.65a | 0.36a | 9.75ab |
| | B | 30 | 2.87c | 4.59c | 3.13b | 0.29cd | 9.1b |
| | | 60 | 2.96bc | 4.4c | 3.35ab | 0.30bcd | 9.0b |
| | C | 30 | 3.01bc | 5.26b | 3.49ab | 0.29cd | 8.15c |
| | | 60 | 3.07ab | 3.52d | 3.33ab | 0.34ab | 10.4a |
| 2nd | Peat | | 2.16h | 4.88g | 2.20f | 0.23d | 10.5bcd |
| | Peat H | | 2.44g | 5.84f | 2.52f | 0.26d | 10.2cd |
| | A | 30 | 2.85cdef | 9.45b | 3.69de | 0.36c | 9.85d |
| | | 60 | 2.97bc | 10.5a | 4.26bc | 0.42bc | 9.85d |
| | | 30H | 2.78f | 8.36c | 3.69de | 0.38bc | 10.4bcd |
| | | 60H | 2.91bcdef | 10.6a | 4.31ab | 0.41bc | 9.60d |
| | B | 30 | 2.81ef | 6.70e | 3.33e | 0.39bc | 11.8a |
| | | 60 | 2.82def | 7.91cd | 3.78de | 0.42bc | 11.0abc |
| | | 30H | 2.82def | 8.46c | 3.45e | 0.38bc | 11.1ab |
| | | 60H | 3.01b | 9.59b | 4.12bcd | 0.42b | 10.4bcd |
| | C | 30 | 2.97bcd | 7.73cd | 3.68de | 0.38bc | 10.9bc |
| | | 60 | 2.81def | 7.12de | 3.77de | 0.42b | 11.2ab |
| | | 30H | 3.15a | 10.1ab | 4.73a | 0.48a | 10.1cd |
| | | 60H | 2.84bcde | 9.57b | 3.82de | 0.40bc | 9.94d |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 12. Cabbage: percentage of "extractable" plants[1].

| Trial | Treatments (% of compost in the mix) | | | | | | |
|---|---|---|---|---|---|---|---|
| 1st | Peat | 30A | 60A | 30B | 60B | 30C | 60C |
| | 87.5a | 93.3a | 36.5b | 88.5a | 67ab | 95.3a | 55.8ab |
| 2nd | Peat | 30A | 60A | 30B | 60B | 30C | 60C |
| | 54.3ab | 18.0cde | 2.75e | 33.3bcde | 19.8cde | 38.5bcd | 37.0bcd |
| | Peat H | 30AH | 60AH | 30BH | 60BH | 30CH | 60CH |
| | 74.0a | 20.8cde | 10.3cd | 19.3cde | 14.5cde | 26.5 bcded | 47.3 abc |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).

Table 13. Pepper: germination percentage[1].

| Trial | Treatments (% of compost in the mix) | | | | | | |
|---|---|---|---|---|---|---|---|
| 1st | Peat | 20A | 40A | 20B | 40B | 20C | 40C |
| 50 dias | 81.0cd | 86.0ab | 77.3d | 86abc | 83.8abc | 92.0a | 84.5abc |
| 2nd | T | - | - | 20B | 40B | 20C | 40C |
| 31 days | 83.0a | - | - | 82.6a | 80.7a | 83.7a | 83.7a |
| | TH | - | - | 20BH | 40BH | 20CH | 40CH |
| 31 days | 83.4a | - | | 82.6a | 88.3a | 85.2a | 84.1a |

[1] For each trial and in each line (nº of days): small letters for mean separation at 5% level (Duncan' Test).

Table 14. Pepper: comparison of composts[1].

| Trial | Compost | D[2] (mm) | H (cm) | FWA (g) | DWA (g) | % DMA |
|---|---|---|---|---|---|---|
| 1st | A | 2.90a | 13.8a | 2.97a | 0.324a | 10.9b |
| | B | 2.87a | 13.6a | 2.78a | 0.345a | 12.2a |
| | C | 2.87a | 13.7a | 2.81a | 0.335a | 11.7a |
| 2nd | B | 2.95a | 14.2a | 2.16a | 0.22a | 9.98a |

| | C | 2.98a | 14.3a | 2.23a | 0.23a | 10.36a |
|---|---|---|---|---|---|---|

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 15. Pepper: mean values of the plant growth variables[2] at the end of the trials[1].

| Trial | Substrate | | D (mm) | H (cm) | FWA (g) | DWA (g) | DMA % |
|---|---|---|---|---|---|---|---|
| 1st | Peat | | 2.78a | 13.3bc | 2.69cd | 0.346a | 12.5a |
| | A[1] | 20[2] | 2.98a | 15.4a | 3.39a | 0.317a | 9.2d |
| | | 40[2] | 2.95a | 12.7c | 2.82bcd | 0.322a | 10.9bc |
| | B | 20 | 2.84a | 13.6bc | 2.54d | 0.342a | 13.3a |
| | | 40 | 2.99a | 13.9abc | 3.09abc | 0.346a | 10.8bc |
| | C | 20 | 2.848a | 15.4a | 2.49d | 0.299a | 12.1ab |
| | | 40 | 2.99a | 14.8ab | 3.26ab | 0.360a | 10.4cd |
| 2nd | Peat | | 2.72d | 12.9e | 1.64d | 0.16e | 9.61d |
| | Peat H | | 3.02bc | 13.9d | 2.05bc | 0.20d | 9.81cd |
| | B[1] | 20[2] | 2.99bc | 14.7abcd | 2.10bc | 0.23c | 11.1a |
| | | 20H | 3.10b | 15.9a | 2.62a | 0.26ab | 10.0cd |
| | | 40[2] | 3.00bc | 15.6ab | 2.65a | 0.26ab | 9.72cd |
| | | 40H | 2.87c | 12.2e | 1.90c | 0.18de | 9.58d |
| | C | 20 | 2.96bc | 14.3cd | 2.18b | 0.24bc | 10.9ab |
| | | 20H | 3.07b | 15.4ab | 2.65a | 0.28a | 10.4bc |
| | | 40 | 2.91c | 14.9abc | 2.22b | 0.25abc | 11.2a |
| | | 40H | 3.23a | 14.4bcd | 2.66a | 0.27a | 10.3bc |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 16. Pepper: comparison of the percentage of the compost in the mix [1].

| Trial | Compost (%) | D[2] (mm) | H (cm) | FWA (g) | DWA (g) | DMA % |
|---|---|---|---|---|---|---|
| 1st | 0 (peat) | 2.78b | 13.3a | 2.7b | 0.346a | 12.5a |
| | 20 | 2.89ab | 14.0a | 2.81ab | 0.320a | 11.5b |
| | 40 | 2.98a | 13.8a | 3.05a | 0.343a | 10.7c |
| 2nd | 0 | 2.73c | 12.9d | 1.64e | 0.16d | 9.61d |
| | 0H | 3.02ab | 13.9bc | 2.05d | 0.20c | 9.81cd |
| | 20 | 2.97b | 14.5b | 2.14cd | 0.23b | 11.0a |
| | 20H | 3.08a | 15.6a | 2.63a | 0.27a | 10.2bc |
| | 40 | 2.95b | 15.2a | 2.43b | 0.25a | 10.5b |
| | 40H | 3.05ab | 13.3cd | 2.28bc | 0.23b | 9.94cd |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).
[2] D, stem diameter; H, plant height; FWA, DWA, canopy fresh and dry weight; DMA, dry matter content.

Table 17. Pepper: percentage of "extractable" plants[1].

| Trial | Treatments (% of compost in the mix) | | | | | | |
|---|---|---|---|---|---|---|---|
| 1st | Peat | 20A | 40A | 20B | 40B | 20C | 40C |
| | 62.5b | 69.3a | 71.3ab | 85.5ab | 74.5ab | 61.0b | 68.8ab |
| 2nd | Peat | - | - | 20B | 40B | 20C | 40C |
| | 36.4a | - | - | 15.5bcd | 11.8bcd | 18.6abcd | 26.5ab |
| | Peat H | - | - | 20BH | 40BH | 20CH | 40CH |
| | 23.9abc | - | - | 4.52cd | 11.8bcd | 1.50d | 3.05d |

[1] For each trial and column: small letters for mean separation at 5% level (Duncan' Test).