International Journal of Current Multidisciplinary Studies
Available Online at http://www.journalijcms.com
Vol. 5, Issue,03(A), pp. 976-979,MARCH,2019

IJCMS

RESEARCH ARTICLE

EARTHWORM HUMUS FOR THE GROWTH OF VEGETABLEPLANTS

Domenico Prisa

CREA Research Centre for Vegetable and Ornamental Crops, Council for Agricultural Research and Economics, Via dei Fiori 8, 51012 Pescia, PT, Italy

A R T I C L E I N F O

Received 6th December,, 2018
Received in revised form 15th January, 2019
Accepted 12th February, 2019
Published online 28th March, 2019

Keywords:

alternative substrates, vegetables, plant quality, soil improver, plant stimulation

A B S T R A C T

In the 20th century, the arrival of intensive agriculture brought about the phenomenon of soil impoverishment. Chemical fertilization methods, the study of appliedgenetics, the mechanization of agriculture and the development of phytosanitary techniques havea llincreased agricultural production. Earthworm humus constitutes an authentic biological fertilizer in terms of organicmaterial and microbial population. The trials performedat CREA-OF, Pescia (PT),showed the ability of earthworm humus to increase the quality of basilplants, strawberry and sage, in terms of vegetative and rootbiomass.

INTRODUCTION

Since the beginning of the 1990s, numerous environmental association shave been pressing in the horticultural nursery field to reduce the use of peatas a substrate for plantgrowth, sustainingthat the naturalenvironments from which peatis extracted are destroyed by thisprocess (Neal., 1991). As a consequence of this attitude, greenhouse cropshaveal ways been in constant search of alternative substrates, characterized for example by mixtures containing peat, pine bark, coconutfiber, pumice, perlit and vermiculite in various percentages.

New components in the substrate can offer better growing conditions for plants and at the same time reduce plant production costs compared to peat (Stamps and Evans, 1999).
A large part of the researchfocused on the study of materials such assolidurban waste or agricultural production residues. At the same time, however, these materials may have disadvantages such as the variability of composition, limited availability and the presence of waste such as glass, fragments, metal, lead and mercury, which make them difficult to process (Konduru and Evans, 1999). Among the organic materials animal manure has been used on agriculturall and for centuries, because it is considered a good supplier of available phosphorus (Wen *et al*., 1997).

In the organic waste sector, earth worms have always shown greater preference for animal waste (Laird and Kroger, 1981). Earth worm production can be both profitable and reduce the environmental impact of animalwaste (Edwards and Fletcher, 1988).

Earth worm compost has a great potential especially used for the formulation of pottedsubstrates (Buchanan *et al*, 1988). Tomar *et al*. (1998) have grown carrot plants (*Daucus carota* L.) in pots containing fielde arth or mixed with vermin compost, achieving higher yields in substrates where vermin compost was present. Kalembasa *et al*. (1998) evaluated the effect of different sources of N (manure, ammonium nitrate and earthworm humus) and obtained higher yields on *Raphanussativus* L. and *Capsicumannum* L. with earthworm.
Earth wormsin fluence the structure of the compost by forming macropores, which allow oxygen to enter, and alsoincrease the stability of the humus and itsability to retain water (Lavelle, 1988; Willems *et al*. 1996). On the occasion of the passage through the worms, notonlyor ganicmatter but also the mineral components that serve asfood are subject to the following to digestive enzymes and a grinding process (Das *et al*., 2007, Sharif and Jan, 2008). A improved grass grow tharound worm waste in dicates in creased availability of plant nutrients, with perhaps nitrogen being the mineral that is subject to the greatest influence (Buckman and Brady, 1976). With in its digestive tract, soil material under goes transformations, with de composition of organic matter and avail ability of nutrients for plants (Balota *et al*., 1998).

In thiscontext, CREA-OF (PT), following coll aboration with the Centre of Tuscan earthworming (CLT),(Orzignano, San Giuliano, (Pi)), has experimented with mixtures of peat and

*✉ ***Corresponding author:* Domenico Prisa**
CREA Research Centre for Vegetable and Ornamental Crops, Council for Agricultural Research and Economics, Via dei Fiori 8, 51012 Pescia, PT, Italy

earth worm humus (in differentpercentages) to evaluate the effectiveness of compost in the production of horticultur alplants (Basil, Strawberry and Sage), as a fertilizer (ifusedatlowerpercentages) or as a real growth substrate when itreplaces 100% peat.

MATERIAL AND METHODS

Greenhouse Experiment and Growing Conditions

The experiments began in early June 2015, were carried out price experimental greenhouses of the CREA-OF of Pescia (Pt), Tuscany, Italy (43°54′N 10°41′E), on plants of basil (Fig.1), strawberry (Fig.2) and sage. The plants for all 3 vegetable species were placed in pots with a diameter of 16, 20 plants for thesis, divided into 4 replicas of 5 plants each. The experimental theses of the test were:

- Control**(CTRL)**: Peat 100% + fertilization (5 kg m−3 of Osmocote Pro® 3 - 4 months containing 190 g kg−1 N, 39 g kg−1 P, 83 g kg−1 K);
- Humus 10% **(HUM10)**: Peat 90% + Humus 10% + fertilization (5 kg m−3 of Osmocote Pro®);
- Humus 20% **(HUM20)**: Peat 80% + Humus 20% + fertilization (5 kg m−3 of Osmocote Pro®);
- Humus 50% **(HUM50)**: Peat 50% + Humus 50% + fertilization ((5 kg m−3 of Osmocote Pro®);
- Humus 80% **(HUM80)**: Peat 20% + Humus 80% + fertilization (5 kg m−3 of Osmocote Pro®);
- Humus 100% **(HUM100)**: Humus 100% + fertilization (5 kg m−3 of Osmocote Pro®);

The substrates used were a universal Brill® soil with a pH of 6 and earthworm humus provided by the Centre of Tuscan earthworming(CLT), (Orzignano-San GiulianoTerme (Pi)), having the following analysis (organic nitrogen (N) 1,9%; total nitrogen (N) 2%; phosphorus (P_2O_5) 0,5%; potassium (K_2O) 0,8%; organic carbon 24,5%; ratio C/N 12,2%; pH 7,5; organic substance 49%; extractable organic substance (% on organic substance) 52,5%. Irrigation water was supplied through the drip irrigation system (2 drippers per pot with a total flow rate of 7.5 L h-1, on average) using a trigging irrigation timer set to four times per day. The measurements carried out at the end of the experimentation on the plants were: plant height, vegetative fresh weight, roots fresh weight, inflorescences fresh weight, beginning of flowering (basil), productivity (considered in terms of fresh weight of the fruits in a cultivation cycle of 3 months (strawberry).

Statistics

The experiment was carried out in a randomized complete block design. Collected data were analysed by one-way ANOVA, using GLM univariate procedure, to assess significant ($P \leq 0.05$, 0.01 and 0.001) differences among treatments. Mean values were then separated by LSD multiple-range test ($P = 0.05$). Statistics and graphics were supported by the programsCostat (version 6.451) and Excel (Office 2010).

RESULTS

Humus treatments significantly increase dall the biometric parameters of the plants analysed. In particular, on basil (Tab.1) the insertion of higher percentages of humus in the substrate determined, compared to the control in peat, a significant proportionalin crease in the height of the plants, in the vegetative freshweight, in the root fresh weight and in flore scences fresh weight. There is also an early flowering rate in the basilplants grown in the substrate where the percentages of substitution of peat with humus werehigher. Also in strawberry (Tab. 2) there is a significan tin crease in vegetative freshweight and root fresh weight a thigher humus concentrations in the substrate. There is also an increase in the production of strawberries, over a predeterminedperiod of time of 3 months, in all the theses in which the humus hasreplaced the mixture of peat. In particular the theses with 80% humus, 90% humus and 100% humus seem to be the mostperforming in fruit production compared to 100% peat control. In (Tab. 3) on sage, alltreatments in which earth worm humus was present resulted in a significant increase in vegetative fresh weight and root fresh weight, passing 38.30 g and 16.63g in 100% humus respectively, compared to 32.20 g and 12.47 g in the peat control.

Table 1 Effect of earthworm humus on Basil plants

Treatment	Plantheight (cm)	Vegetative fresh weight (g)	Root fresh weight (g)	Inflorescences fresh weight(g)	Start of flowering (date)
CTRL	7.29 a	35.72 e	22.47 f	8.07 e	july 30th
HUM10	7.46 d	36.43 e	25.27 e	8.13 e	July 26th
HUM20	7.83 c	38.27 d	28.33 d	9.57 d	July 25th
HUM50	8.22 b	43.30 c	29.97 c	10.40 c	July 23th
HUM80	8.74 a	44.67 bc	32.33 b	11.17 b	July 20th
HUM90	8.89 a	45.57 b	33.67 ab	12.23 a	July 19th
HUM100	8.90 a	47.47 a	34.33 a	12.57 a	July 19th

There is also an increase in the colouring of the leaves in the these sathigher percentages of humus mixture, perhaps due to the richuseful microfauna that can play a significantrole in determining a greater absorption by the plants of nutrients present in the substrate.

Each valuere ported in the graphis the mean of threer eplicates ± standard deviation. Statistical analysis performed throughone-way ANOVA. Different letters for the same parameter indicate significant differences according to LSD test (P = 0.05).

Table 2 Effect of earthworm humus on Strawberry plants

Treatment	Fruit production (g)	Vegetative freshweight (g)	Rootfresh weight(g)
CTRL	85.67 e	67.30 f	36.00 e
HUM10	91.33 d	69.20 e	37.73 d
HUM20	95.27 c	72.30 d	40.17 c
HUM50	97.27 b	74.97 c	42.83 b
HUM80	99.20 a	76.53 b	43.70 ab
HUM90	99.43 a	78.07 a	44.73 a
HUM100	99.90 a	78.70 a	44.90 a

Each valuer eported in the graphis the mean of threereplicates ± standard deviation. Statistical analysis performed throughone-way ANOVA. Different letters for the same parameter indicate significant differences according to LSD test (P = 0.05).

Table 3 Effect of earthworm humus on Sage plants

Treatment	Vegetative freshweight (g)	Rootfresh Weight (g)
CTRL	32.20 f	12.47 g
HUM10	33.47 e	12.87 f
HUM20	34.63 d	14.23 e
HUM50	35.90 c	14.93 d
HUM80	37.17 b	15.47 c
HUM90	37.73 ab	16.23 b
HUM100	38.30 a	16.63 a

Each valuere ported in the graphis the mean of three replicates ± standard deviation. Statistical analys is performed through one-way ANOVA. Different letters for the sameparameter indicate significant differences according to LSD test (P = 0.05).

Fig 1 Basil plants in cultivation

Fig 2 Strawberryplants on a cultivationbench

DISCUSSION

The experiments have shown the ability of earthworm humus, when placed in a growing medium, to significantly increase the quality of basil, strawberry and sageplants in terms of vegetative and radical biomass and to influence their productivity (especially in strawberry). This improvement could be due in particular to the rich presence of microbial flora that gene is found in earthworm humus, which can modify the structure of the substrate, in particular by increasing the presence of oxygen, stabilizing the material and increasing the capacity to retain water (Lavelle, 1988; Willems *et al*. 1996;Núñez,2000;Álvarez-Solís *et al*., 2010). These microor ganisms are very of tenable to solubilize the nutrients already present in the substrate or to create symbiosis with the rootsystems of plants, increasing the absorption capacity of nutrients (Schüssler *et al*., 2001). The earth worm humus, also on the basis of the results of this test, can there fore certainly be considered a valid substitute for organic materials included in growth substrates used in horticulture. It can certainly lead to an improvement in plant quality and a significantreduction in the use of peat. At lowpercentages (10%-20% mixture) earth worm humus can be a good organic fertilizer, which can ensure a reduction of synthetic fertilizers, while a thigher percentages (90%-100%) can be considered a real substrate of cultivation, able to replace the peat in part or totally.

CONCLUSION

These trials showed several benefits that can be obtained through the use of earth worm humus:improvement quality of basil, strawberry and sageplants in terms of vegetative and radical biomass and to influence their productivity, better use of fertilizers and water. The test also showed that Earth worm humus can there fore certainly be considered a valid substitute for organic materials included in growth substrate sused in horticulture.

References

Álvarez-Solís, J.D., D.A. Gómez-Velasco, N.S. León-Martínez& F.A. Gutiérrez-Miceli. 2010. ManejoIntegrado De Fertilizantes Y AbonosOrgánicos En ElCultivo De Maíz. Agrociencia 44: 575-586

Balota, E. L.; Hungria, M.,ColozziFilho, A. Biologia Do Solo. In: Salton, J. C.; Hernani, L. C.; Fontes, C. Z. (Orgs.). 1998. Sistema PlantioDireto: O ProdutorPergunta, A EmbrapaResponde. Brasília: Embrapa-Spi; Dourados: Embrapa-Cpao, P. 91-102

Buchanan, M., Russell, G. and Block.,S., 1988. Chemical characterization and nitro genmineralization potential of vermin compost derived from differing organic wastes. p. 231-239. In: C. Edwards and E. Neuhauser (eds.). Earthworms in waste and environmental management. Academic Publishing, The Hague, The Netherlands.

Buckman, H. O., Brady, N. C. , 1976.Natureza E Propriedades DosSolos. Tradução De Antônio B. FigueiredoFilho. 4. Ed. Rio De Janeiro: F. Bastos, 594 P. Cap. 5, P. 130-155.

Das, K., R. Dang, T.N. Shivananda& N. Sekeroglu. 2007. InflUence Of Bio-Fertilizers On The BiomassYield And Nutrient Content In SteviaRebaudiana Bert. Grown In Indian Subtropics. Journal Of Medicinal Plants Research 1(1): 5-8.

Edwards, C., and K. Fletcher., 1988.,Interactions between earthworms and microor ganisms in organic matter break down. Agr. Ecosyst. Environ.24:235-247.

Kalem basa, S., J. Deska, and Z. Fiedorow., 1998. The possibility of utilizin gvermicomposts in the cultivation of radish and paprika (in Polish). Ann. Agr. Acad. Poznan 27:131-136.

Konduru, S., and M. Evans., 1999. Coconuthusk and processing effects on chemical and physical properties of coconut coir dust. HortScience 34:88-90.

Laird, J., and M. Kroger., 1981. Earth worms, anatomy, ecology, soil fertility, waste management. CRC Crit. Rev. Environ. Control 11:189-218.

Lavelle, P., 1988. Earthworms activity in the soil system. Biol. Fertil. Soil. 6:237-251. Neal, K. 1991. Examine medium alternatives. Greenhouse Manager 10:42-48.

Neal, K. 1991. Examine medium alternatives. Greenhouse Manager 10:42-48. Stamps, R., and M. Evans. 1999. Growth of Dracaena marginata and Spathiphyllum 'Petite' in sphagnum peat and coconut coir dust-based growing media.J. Environ. Hort. 17:49-52.

Núñez, M.A., 2000. Manual De TécnicasAgroecológicas. Programa De Las NacionesUnidas Para El Medio Ambiente. Red De Formación Ambiental Para América Latina Y El Caribe. México, D.F. 96 Pp

Schüssler, A., Schwarzott,D., Walker.,C., 2001. A New Fungal Phylum, The Glomeromycota: Phylogeny And Evolution. MycologicalResearch 105: 1413-1421.

Sharif, M.,Jan.,B., 2008. Growth And NutrientsAccumulation Of Maize Plants As Affected By The Inoculation Of Arbuscular Mycorrhizal Fungi With Rock Phosphate. Soil And Environment 27(1): 109-115.

Stamps, R., and Evans.,M., 1999. Growth of Dracaena marginata and Spathiphyllum 'Petite' in sphagnum peat and coconut coir dust-based growing media.J. Environ. Hort. 17:49-52.

Tomar, V., Bhatnagar, R. and Palta.,R., 1998. Effect of vermicompost on production of brinjal and carrot. Indian Agr. Res. J. 13:153-156.

Wen, G., Bates, T., Voroney, R., Winter, J. and Schellenbert.,M., 1997. Comparison of phosphorus availability with application of sewage sludge, sludge compost, and manure compost. Comm. Soil Sci. Plant Annu. 28:1481-1497.

Willems, J., Marmissen, J. and Blair.,J., 1996. Effects of earthworms on nitrogen mineralization. Biol.Fertil. Soils 23:57-63.

****