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THE INFLUENCE OF IAA CONTENT ON THE PHENOL OXIDASE ACTIVITY IN COMMERCIAL GROWING MEDIA USED FOR ORNAMENTAL PLANTS CROP

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SUMMARY

Phenol oxidase has been found to be one of the scarce enzymes capable of decomposing phenolic compounds. Different types of peat and commercial substrates for rooting of cuttings and various concentration of IAA (200 μg kg^{-1}, 300 μg kg^{-1}, 400 μg kg^{-1}) were tested in this experimental trial. Following commercial growing media was used: “Klasmann Steck Medium” (Kronen Klasmann) for rooting cuttings. Phenol oxidase activity was determined in commercial growing media. The obtained results revealed the impact of the IAA content on phenol oxidase activity. However, an increase phenol oxidase activity with IAA content of 200 μg kg^{-1}, 300 μg kg^{-1} and 400 μg kg^{-1} was observed. In control combination (without IAA) lower the phenol oxidase activity was confirmed.

KEYWORDS: commercial growing media, phenol oxidase activity, IAA

INTRODUCTION

Growing media are materials in which plants are grown. They include all such materials that are used in the professional and hobby markets, whether produced by the growing media industry or by growers as own-mixes. Media for all types of plant cultivation, usually in containers, are included; as well as fertilized planting media e.g. for trees and shrubs, and casing soil for mushrooms. Growing media constituents are the basic components of mixes, which are generally formulated on a percentage volume basis. Such materials include peat, composted biodegradable waste, composted bark, wood fibre, coir, perlite, vermiculite and others. Growing media constituents can usually be sensually detected in the mix. Growing media additives are additional ingredients of mixes, which are usually added to the mix on a weight basis by the gram or kilogram. Additives include fertilizers, liming materials, buffering materials, binders, wetting agents, hydrogels, chemical pesticides, biological products, dyes and other substances. Often, due to their low rate of application and physical state, additives cannot be sensually detected within the mix (Schmilewski, 2008).

The availability of free indole-3-acetic acid (IAA), the biologically active form of auxin, plays an important role in the development of a plant through-out its life cycle (Ostrowski and Jakubowska, 2008). Plant growth regulators (phytohormones) are organic substances, which at low concentrations, promote, inhibit, or modify the growth and development of plants. The plant hormone is an organic compound synthesized in one part of the plant and trans- located to another, where in very low concentrations it causes a physiological response as a curvature

of oat coleoptiles towards light (Martinez-Morales *et al.,* 2003). Applications of the amounts of chemical compounds characterizing hormonal effect or hormonal-like effect have become important agricultural production practices, particularly in horticulture, agriculture, pomology, floriculture as well as for growing media. Indole-3-acetic acid is a phytohormone of the auxin series; its biosynthesis, besides higher plants, is also performed by a number of soil microorganisms, and in particular, plant growth-promoting rhizobacteria. IAA seems to play an important function in nature as a result of its influence in the regulation and development of plant growth. The physiological impact of this substance is involved in cell elongation, apical dominance, root initation, parthenocarpy, abscission callus formation and respiration. IAA is a common product of L-tryptophan (TRP) metabolism by soil fungi and bacteria including those which can stimulate plant growth. IAA is synthesized by two distinct pathways: TRP is converted to IAA by deamination to indole-3-pyruvic acid (IPyA) followed by decarboxylation to indole-3-acetaldehyde (IAAId) which is further oxidized to IAA. The second pathway: TRP is decarboxylated to indole-3-acetamide (IAM) which is hydrolyzed to IAA (Arshad and Frankenberger, 1991; Kamnev *et al.,* 2001; Halda-Alija, 2003; Neşe-Çokuğraş and Bodur, 2003; Szajdak and Maryganowa, 2007).

The aim of our investigations was to evaluate the impact of various concentration of IAA on the phenol oxidase activity in commercial growing media.

MATERIALS AND METHOD

Different types of peat and commercial substrates for rooting of cuttings and various concentration of IAA (200 μg kg^{-1}, 300 μg kg^{-1}, 400 μg kg^{-1}) were tested in this experimental trial. Following commercial growing media was used: “Klasmann Steck Medium” (Kronen Klasmann) for rooting cuttings. Phenol oxidase activity were determined in commercial growing media. Phenol oxidase was determined by Perucci method (Perucci *et al.,* 2000; Szajdak *et al.,* 2011a, b).

RESULTS

Extracellular enzymes mediate the degradation, transformation and mineralization of soil organic matter. Phenol oxidase acts upon otherwise recalcitrant compounds and stimulates decomposition. Indirectly, phenol oxidase enhances decomposition by degrading soluble phenolic compounds and thus eliminating their inhibitions on hydrolytic enzyme activities. This indirect pathway has been developed as an ‘enzymatic latch mechanism’ that underlies soil carbon loss from drained peatlands (Yao *et al.,* 2009). The phenol oxidase is enzyme that catalyzes the oxidation of phenolic compounds to quinones, participates in the formation of humic acids, and indicates the capacity of the microflora degrade recalcitrant organic substances. Extracellular phenol oxidase pools comprise of an array of different types of phenol oxidase enzyme known microbial producers include fungi and bacteria. Phenol oxidases act upon complex and simple phenolics, with outcomes ranging from partial oxidation and the release of oxidative intermediates, to complete degradation. Polyphenolics inhibit decomposition by binding to the reactive sites of extracellular enzymes and through the formation of phenolic complexes. The activity of extracellular phenol oxidases may therefore affect the retention of carbon in the litter and soil environment directly via the breakdown of recalcitrant organic matter, and indirectly by releasing extracellular hydrolase enzymes from phenolic inhibition (Toberman *et al.,* 2008; Sinsabaugh, 2010). The phenol

oxidase is enzyme that catalyzes the oxidation of phenolic compounds to quinones, participates in the formation of humic acids, and indicates the capacity of the microflora degrade recalcitrant organic substances. Phenol oxidase is one of the few enzymes able to degrade recalcitrant phenolic materials as lignin. In our investigation the lowest phenol oxidase activity was measured in the control combination (without IAA) (10.34 μmol h^{-1} g^{-1}) and the highest with IAA content of 200 μg kg^{-1} (16.62 μmol h^{-1} g^{-1}), 300 μg kg^{-1} (17.16 μmol h^{-1} g^{-1}) and 400 μg kg^{-1} (16.91 μmol h^{-1} g^{-1}) (Table 1).

Table 1. Phenol oxidase activity in commercial growing media

Sampling (concentration of IAA)	Phenol oxidase activity (μmol $h^{-1}g^{-1}$)
Control (without IAA)	10.34
200 μg kg^{-1}	16.62
300 μg kg^{-1}	17.16
400 μg kg^{-1}	16.91

CONCLUSION

The obtained results revealed the impact of the various concentrations of IAA on phenol oxidase activity. However, an increase phenol oxidase activity with IAA content of 200 μg kg^{-1} 300 μg $kg^{-1}$and 400 μg kg^{-1} were observed. In control combination (without IAA) lower the phenol oxidase activity was confirmed.

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