28th Conference Asic 2021
From 28 June to 1 July 2021

S3-P-07

Effects of different substrate formulations on coffee seedlings production

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Introduction

In plant coffee propagation, the seedlings quality and the production costs are two important aspects. The nursery production of coffee seedlings affects the plant behavior just after transplant, the beginning of production, the potential productivity and the final quality. Likeways, the reduction of time for growing ready for transplantation plants decreases the nursery production costs.

The aim of this work was to study the influence of different formulations of growing media on seedlings quality of *Coffea arabica* L.

The following description factors were studied:

- phosphorus dosage
- addition of mycorrhizae
- addition of biostimulant.

All factors were applied during the substrate formulation.

Materials/Methods

Trials were carried out during 2018, using as common substrate for all treatments a mixture of coarse peat (H3,10-25 mm, 30% v/v), medium size peat (H5, 0-15 mm, 30% v/v), coir pith medium-coarse size (20% v/v) and pumice (3-8 mm, 20% v/v). At the phenotypic stage of two true leaves the seedlings were repotted from plug tray to a 1 liter plastic pot. Trials were performed in two nurseries in Northern Italy using the same experimental design (randomized block with 5 replications) and the same cultivar *Laurina*.

Fertilizer. Substrates were prepared using a fertilizer amount of 1 kg/m^3 NPK + trace elements, using two phosphorus dosages (11.1 and 2.8 g/m^3) (in order to evaluate effects on mycorrhizae development, rooting and plant height).

Mycorrhizae. Mycorrhizal inoculum of *Glomus intraradices* and *Glomus mosseae* at the rate of 0,25 g/L was added.

Biostimulant. A biostimulant, able to increase the plant's ability to absorb the nutritive elements and containing betaine, alginic acid and caidrine, was added to the substrate (1,5 kg/L), alone or together with mycorrhizae.

Tab. 1: Influence of phosphorus dose on some morphological parameters of seedlings after six months

FACTOR	SPAD	Plant height (m) A	Hypocotil diam. (mm) B	Internod (n°) C	Lateral branches (n°)	C/A	B/A	Fresh weight (g)	Dry matter (%)	Rooting score (5 max)
High Phosphorus vs Low Phosphorus	56,9 a 60,8 a	0,374 a 0,352 b	4,93 a 4,81 b	10,1 a 10,0 a	4,12 a 3,62 b	26,9 b 28,5 a	13,2 a 13,7 a	72,3 a 73,4 a	23,5 a 23,6 a	3,00 a 3,25 a

Tab. 2: Influence of mycorrhizae on some morphological parameters of seedlings after six months

FACTOR	SPAD	Plant height (m) A	Hypocotil diam. (mm) B	Internod (n°) C	Lateral branches (n°)	C/A	B/A	Fresh weight (g)	Dry matter (%)	Rooting score (5 max)
Mycorrhizae+ vs Mycorrhizae -	58,6 a 58,9 a	0,355 a 0,363 a	4,62 a 4,87 a	10,2 a 10,1 a	3,5 a 4,0 a	28,7 a 27,7 a	13,0 a 13,4 a	72,8 a 67,7 b	22,6 a 23,6 a	3,51 a 3,12 a

Tab. 3: Influence of biostimulant on some morphological parameters of seedlings after six months

FACTOR	SPAD	Plant height (m) A	Hypocotil diam. (mm) B	Internod (n°) C	Lateral branches (n°)	C/A	B/A	Fresh weight (g)	Dry matter (%)	Rooting score (5 max)
Biostimulant+ vs Biostimulant -	57,6 a 58,9 a	0,374 a 0,363 a	4,87 a 4,87 a	10,4 a 10,1 b	3,67 a 4,0 a	27,8 a 27,7 a	13,0 a 13,4 a	67,6 a 72,8 a	22,9 a 23,5 a	4,00 a 3,12 b

Tab. 4: Influence of biostimulant and mycorrhizae on some morphological parameters of seedlings after six months

FACTOR	SPAD	Plant height (m) A	Hypocotil diam. (mm) B	Internod (n°) C	Lateral branches (n°)	C/A	B/A	Fresh weight (g)	Dry matter (%)	Rooting score (5 max)
Biostimulants and Mycorrhizae+ vs Biostimulants and Mycorrhizae -	56,3 a 58,9 a	0,37 a 0,363 a	4,71 a 4,87 a	10,4 a 10,1 a	4,1 a 4,0 a	28,1 a 27,7 a	12,7 a 13,4 a	69,6 a 72,8 a	23,1 a 23,6 a	3,94 a 3,12 b

Figure 1: plants at the end of the trial. From left to right **1**-High phosphorus (HP); **2**-HP+Mycorrizae (M); **3**-HP+biostimulant (B); **4**-HP+M+B; **5**-Low Phosphorus (LP); **6**-LP+M; **7**-LP+B; **8**-LP+M+B

Results/Discussion

Phosphorus dosage. After three months, the highest amounts of phosphorus improved hypocotyl diameter and lateral branches, with a slight reduction in the compactness index. At the end of the experiment, despite a small reduction of seedling compactness, the plant height, hypocotyls diameter and lateral branches were positively affected by high phosphorus values. No reduction in root growth was observed (unlike what often on other species).

Mycorrizae. The mycorrhizal inoculum positively influenced only the foliage fresh weight. The reduction of phosphorus fertilization did not affects the plant answer to the mycorrhizae.

Biostimulant. The use of biostimulant delayed the early development of lateral branches. At the end of the experiment no difference were noted for lateral branches whereas statistical difference was observed on root growth (+ 28%).

Mycorrizae and biostimulant. The combined use of biostimulant and mycorrhizae gave the same results observed on the biostimulant alone, that is delay in the early production of plagiotropic branches but a final improved rooting.

Conclusion/Perspectives

The fertilization formula containing the highest amount of phosphorous influenced the main morphological parameters stimulating the earliest emission of plagiotropic branches, usually bearing flowers and fruits. Contrary to expectations, the substrate mycorrhization did not affect the final results, probably due to its negligible colonization. The addition of biostimulant enhanced the root growth but delayed the emission of plagiotropic branches. Also the combined use of biostimulant and mycorrhizae did not provide a clear advantage, in spite of the highest cost of substrate. Based on these data, the substrate which provided the best results at lowest cost was the one containing the common fertilizing formula with the highest content in phosphorous.

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Gazzetta Ufficiale della Repubblica Italiana n° 230 del 3 ottobre 2011 – supplement n° 10

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