Pseudomonas putida FB strain acts as a Plant Growth Promoter in several substrates containing different amounts of organic matter

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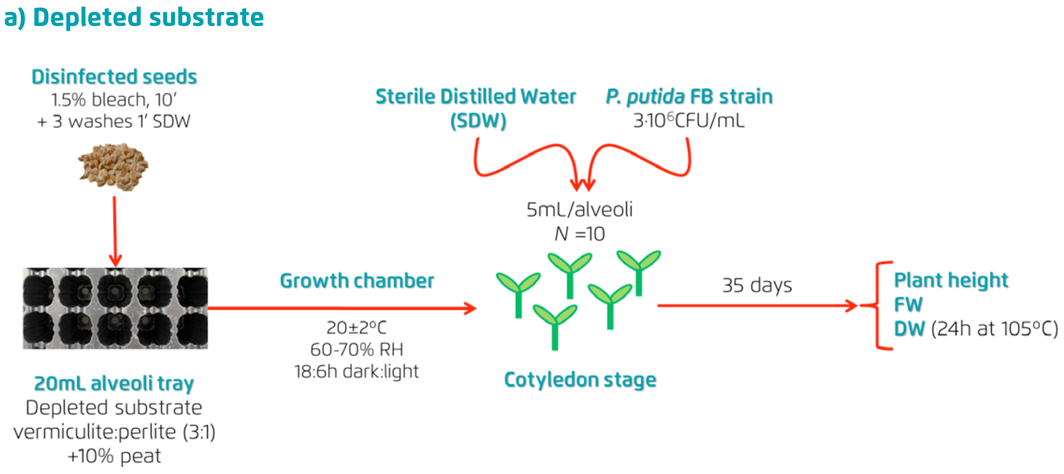
ABSTRACT: The single inoculation with 5mL *P. putida* FB strain in seedlings grown in depleted ($3{\cdot}10^6$ CFU/mL) or commercial ($3.6{\cdot}10^7$ CFU/mL) substrate resulted in an impressive plant growth increase (27-fold and 75%, respectively), relative to dry weight in control plants. Moreover, transplanting and immediately treating ($4.8{\cdot}10^7$CFU/mL of *P. putida* or water, including all combinations) those plants previously grown and treated on commercial substrate to 350mL pots filled with standard substrate (loamy sand soil, 3.55% OM, pH=7.7, 39.3 mmol/Kg CEC) showed that maximum growth increase (0.28-fold increase) was achieved by the two-step inoculation treatment at cotyledon stage and at transplanting. On the other hand, when a unique treatment with *P. putida* was applied to such plants, maximum growth was reached with the inoculation at transplanting.

INTRODUCTION: Several *Pseudomonas* sp., particularly *P. putida* and *P. fluorescens*, have been reported as plant growth promoters (PGP) [1]. Such plant growth-enhancer effect might be due to several metabolic traits of these bacteria such as auxins or siderophore production [2]. However, background levels of wild strains might alter the effect on plant growth from external bacterial inoculation. A two-step assay was carried out to test (i) the effect of *P. putida* FB strain in plant growth in both depleted (10% peat) and commercial (50% peat) substrates (ii) and the number of inoculations carried out under commercial conditions.

MATERIALS:

a) Depleted substrate



b) Commercial and standard substrates

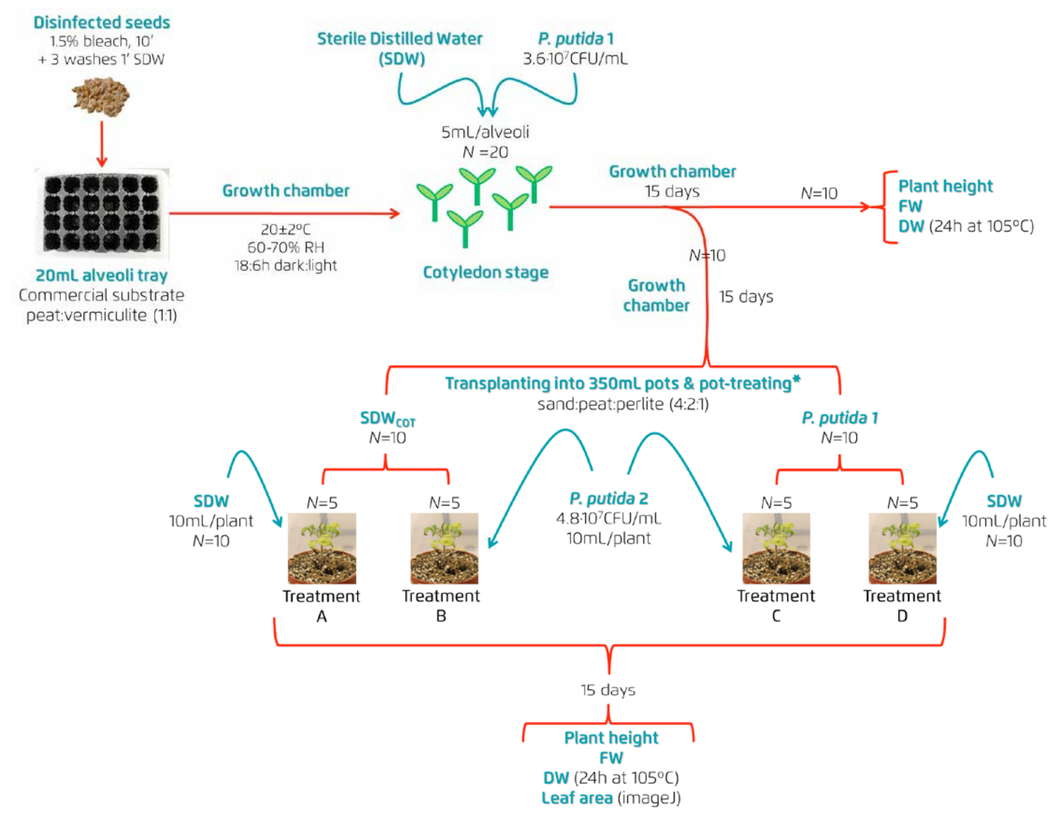


Fig. 1 Control (left) and *P. putida* FB strain (right) treated plants grown in depleted substrate at 35days after inoculation.

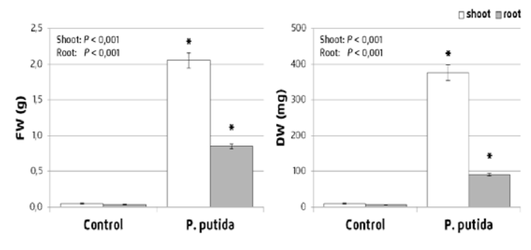


Fig. 2 Plant fresh (FW) and dry weight (DW) of tomato control and inoculated plants grown under nutrient limitation at 35days after treatments.

RESULTS: A unique treatment with *P. putida* FB strain on tomato seedlings grown under nutrient limitation for 35 days exerted a notable effect on plant growth **(Fig. 1)**, also reflected in terms of plant FW and DW **(Fig. 2)**. A single treatment with *P. putida* on seedlings grown in commercial substrate did not show visual growth promotion. Consequently, shoot height but also shoot and root FW were not increased. Nonetheless, both shoot and root DW did significantly increase **(Fig. 3)**, suggesting that the inoculation indeed had an effect on plant growth. Moreover, a second inoculation at transplanting resulted into a notable growth **(Fig. 4)** and statistically increases in terms of shoot height and leaf area **(Fig. 5)**. The combined treatment also increased root FW and shoot FW and DW **(Fig. 6)**. Besides, plants that received a unique application of *P. putida* FB strain also showed an improved (but lower than the 2-inoculation treatment) shoot height, irrespective to the time of treatment application. However, in terms of plant tissue weight, inoculation at transplanting appears to better improve plant growth than cotyledon treatment **(Fig. 6)**.

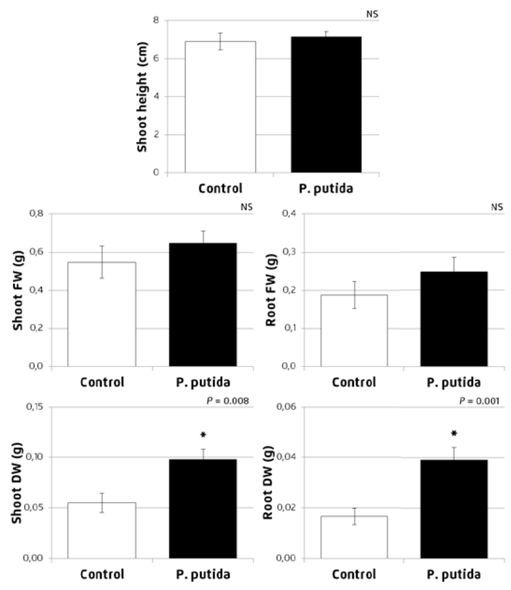


Fig. 3 Plant growth parameters analysed in tomatoes grown in commercial substrate and treated at seedling stage after 15 days post-inoculation.

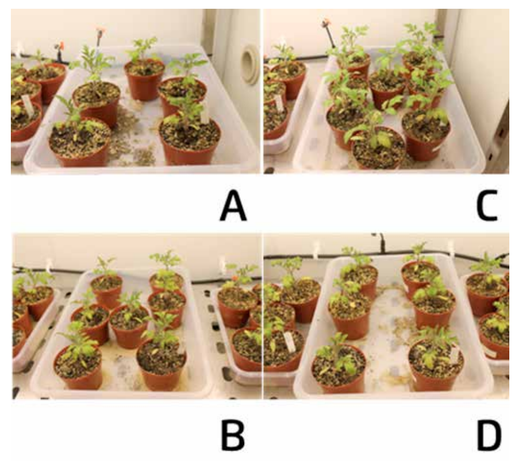


Fig. 4 Transplanted plants from commercial to standard substrate after 10 days from the second treatment

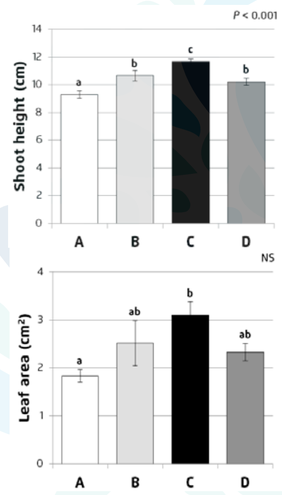


Fig. 5 Shoot height and leaf area from potted plants after 15 days of transplanting treatments

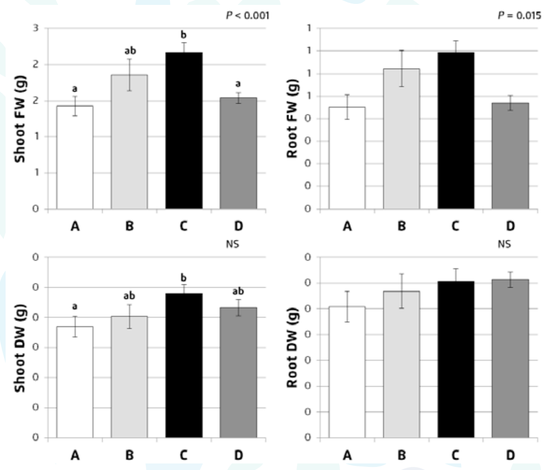


Fig. 6 Shoot and root fresh (FW) and dry weight (DW) of control and *P. putida* FB strain treated potted-plants.

CONCLUSIONS: *Pseudomonas putida* FB strain promotes plant growth in tomato plants, specially under conditions of nutrient limitation. When organic mater content in soil is no limiting plant growth, a single inoculation at transplanting seems to exert a greater effect than treating at cotyledon stage. Under commercial and standard conditions, a two-step inoculation is the most effective treatment for enhancing plant growth in tomato.

REFERENCES:

[1] Kloepper, J.W., Lifshitz, R. & Schroth, M.N. (1988). "*Pseudomonas* inoculants to benefit plant production". ISI Atlas of science: Animal and plant sciences/1988: 60-64.

[2] Saharan, B.S. & Nehra, V. (2011). "Plant growth promoting rhizobacteria: A critical review". Life Sciences and Medicine Research, vol. 2011: LSMR-21.