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Biostimulant potential of *Tenebrio molitor* frass in tomato cultivation under NFT hydroponic system

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INTRODUCTION & AIM

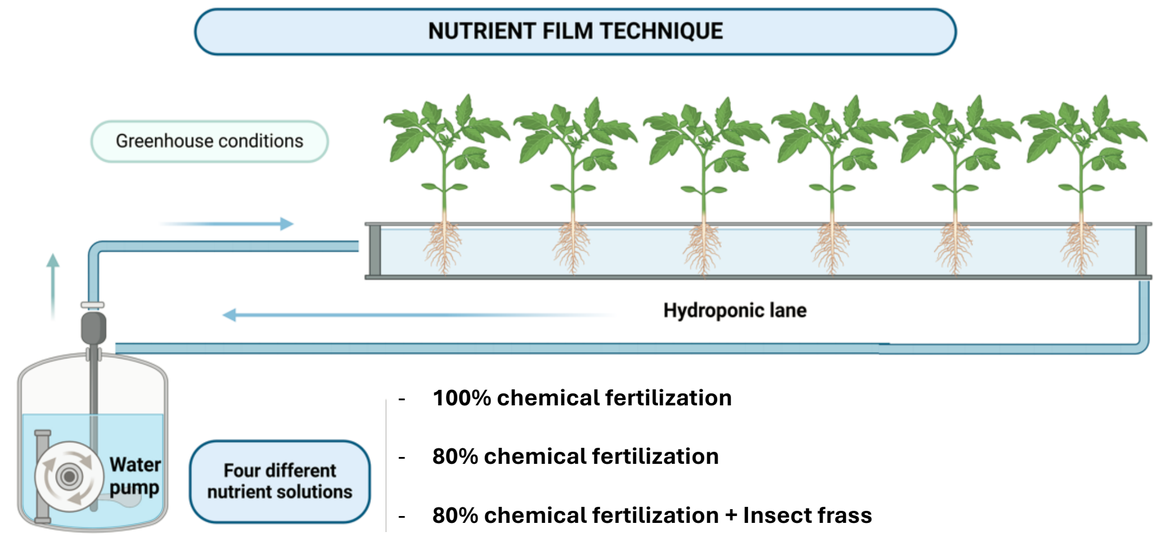
Chemical inputs have had a major impact on agriculture, driving its industrialisation and boosting food production. However, their use comes with significant drawbacks: increased vulnerability to price fluctuations, pollution, and ecosystem degradation highlight the need for more environmentally sustainable alternatives. In response, the new European regulation under the *Farm to Fork Strategy* aims to substantially reduce the use of fertilisers and plant protection products.

Frass from *Tenebrio molitor* larvae fed on plant waste has emerged as a sustainable alternative. This insect excrement shows great potential as both an organic fertiliser and a biostimulant. The present study investigates its application in an NFT hydroponic system, yielding promising results. The main objective is to maintain—or even increase—food production while reducing chemical fertiliser use by 20%.

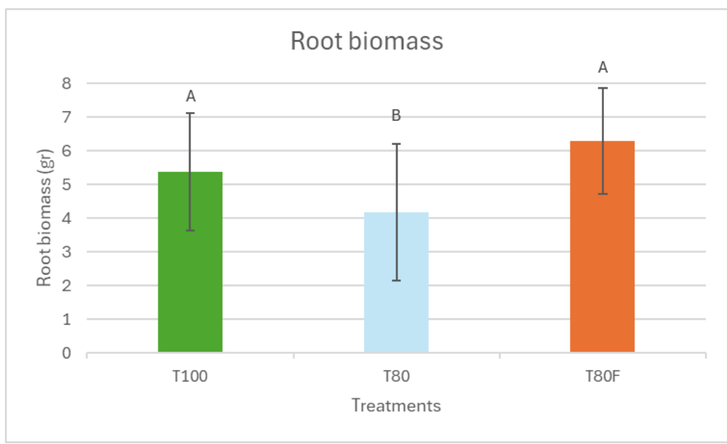
METHOD

This study evaluated the use of *T. molitor* frass in a Nutrient Film Technique (NFT) hydroponic system for tomato cultivation (*Solanum lycopersicum*). Three treatments were established: T100 (100% conventional chemical fertilization), T80 (20% reduction in chemical fertilization), and T80F (T80 supplemented with frass).

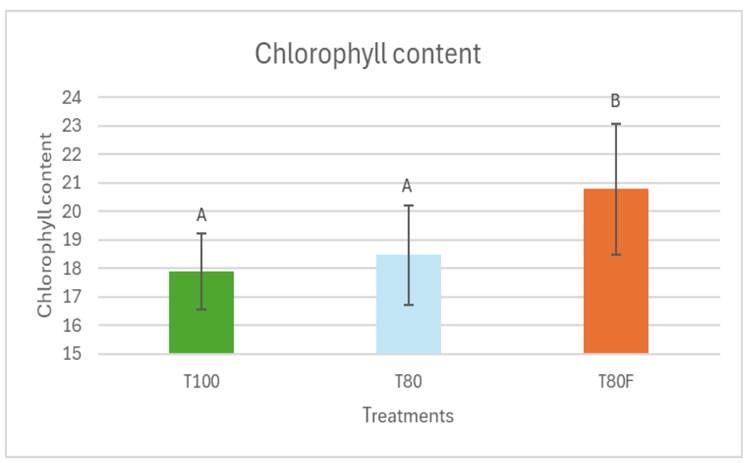
The objective was to determine whether frass supplementation could compensate for reduced chemical input without compromising yield or quality. Physiological, morphological, productive, and organoleptic variables were monitored.



RESULTS & DISCUSSION

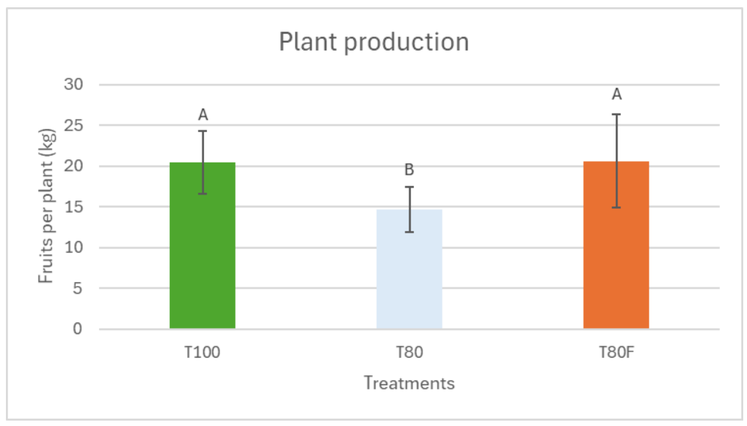


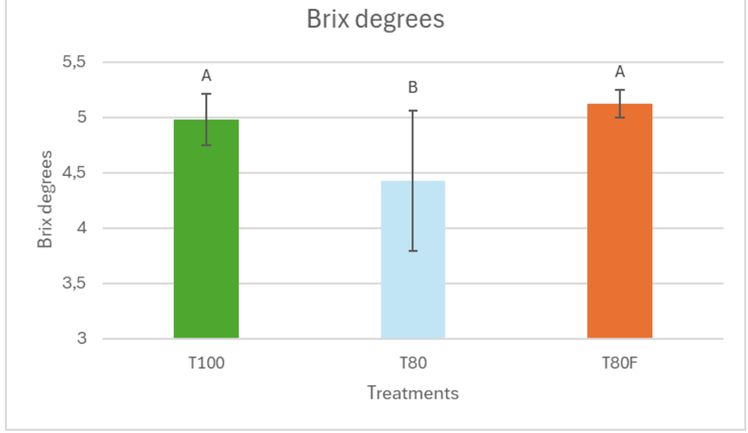
Greater root development was observed in the channels supplemented with frass



Chlorophyll content was higher in the channels supplemented with frass

No significant differences were observed in tomato production between the 100% and 80%F treatments, indicating that a 20% supplementation with frass allows maintaining optimal production levels





A higher Brix content was detected when frass was added to the 80% fertilization treatment. Moreover, during the tasting, the frass-supplemented tomatoes received the same level of acceptance as those without frass.

CONCLUSION

Frass supplementation allowed tomato plants with nutrient deficiencies to achieve growth equal to or greater than those grown under optimal fertilization levels. Insect farming is increasing exponentially, and consequently, so are all the by-products associated with it. It is therefore important to find valorization solutions. Agriculture must adapt to the reduction of chemical fertilizers. The small amount of frass added to the channels suggests that these results may be influenced by the presence of beneficial microorganisms. Therefore, future studies will focus on exploring the microbial community present in frass and its role in promoting plant development.

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