CONCLUSION
In conclusion,

- We could able to identify a potential biocontrol agent *T. harzianum* OTPB3 which exhibited all possible biocontrol mechanism of action.

- This biocontrol agent managed late BLIGHT successfully in both greenhouse and at field condition.

- In the present study volatile compounds from highly efficient biocontrol strains *T. harzianum* OTPB3 was evaluated and showed antimicrobial property.

- Among 94 volatile compounds identified, β-caryophyllene, 1,8 cineole, p-cymene and 1-octen-3-ol exhibited 100% inhibition of pathogen. But β-caryophyllene significantly increased the seedling vigour index and seedling weight of tomato in comparison with control.

- The defence related genes showed significant increase in their expression in β-caryophyllene treated tomato seedlings. PR-6 gene, a basic proteinase inhibitor and a Jasmonic acid (JA)/ethylene (ET) responsive marker gene showed highest expression of 6.36 folds in β-caryophyllene treated seedlings.

- Seed treatment with biocontrol agent OTPB3 promoted growth in tomato plants by inducing growth hormones IAA and GA3 and reduced lesion size by inducing systemic resistance against *P. infestans*. Even it got better, when combined with another potential biocontrol agent *B. subtilis* OTPB1.

- This consortium promoted plant growth and induced systemic resistance against late blight and reduced late blight infection significantly. Hence this
combination was formulated with organic carrier material and seed coating formulation was formulated, christened as Seedpro.

- This product was commercialized to three companies’ viz., M/s Multiplex Biotech. Pvt. Ltd, Bangalore, M/s. Agri Life Pvt. Ltd., Hyderabad and M/s. Poabs Biotech, Kerala.

- Based on life cycle of *P. infestans*, Soil formulation and foliar spray was formulated which significantly reduced late blight infection in both greenhouse condition and field condition but in field condition oil formulation was integrated with different sequence of fungicides, which found to be superior with comparison to yield which significantly increased in yielded with 145.9 kg/plot (p < 0.05) followed by sequence 1, 2, 3 with 128.5, 117.1, 127 kg/plot respectively where control plot yielded 42.7 kg/plot. Even sequence 4 was found to be on par with respect to AUDPC which was significantly reduced in all the treatments compared to control among which found to be superior in reducing the disease with 817.3 followed by other sequential sprays where 3282.6 AUDPC recorded in control.

- Being a potential biocontrol agent exhibiting all possible mechanisms of biocontrol agent, isolate *Trichoderma harzianum* OTPB3 was subjected for whole genome sequencing. The genome sequence of *T. harzianum* OTPB3 was obtained using Illumina Hiseq2000 platform.

- A guided whole genome assembly of *T. harzianum* OTPB3 was performed using *T. harzianum* CBS 226.95 v1.0 as reference. A draft genome assembly of 38.01 Mb was obtained which was in agreement with the earlier sequenced *Trichoderma* isolates.
The predicted gene models were analysed using Blast2GO to identify gene function. The GO terminologies were placed into three broad categories: molecular function (MF), biological processes (BP) and cellular components (CC). Below table represents the top ten molecular function (MF), biological processes (BP) and cellular components (CC) in the T.harzianum genome.

Hence, the present study revealed significance in the production of disease free quality vegetable transplants and management of late blight of tomato. This study also emphases on the ability of bio-control agents to promote plant growth promotion and to induce systemic resistance in tomato plants against P. infestans and range of the vegetable crops. Further, this investigation not only highlights the development of bio-control formulation but also showed the way for identification of potential antifungal secondary metabolites for development of green technologies for management of fungal diseases of vegetable crops.