SUMMARY AND CONCLUSION

An experiment was conducted at IIHR, Varanasi during the cropping season of tomato 2012-13 and 2013-14 to find out the effect of different parameters viz, survey of the disease, etiology of the pathogen, studies of pathogen, survivability, effect of disease on yield parameters, disease incidence, and evaluation of chemicals, and bio-agent against the disease under laboratory conditions and evaluation of bio-agents and chemical against the disease under field conditions.

A survey conducted in Indian Institute of Vegetable Research in Varanasi during Kharif 2012-13, 2013-14. Six isolates of *Alternaria solani* were obtained from the infected tomato leaf sample showing typical early blight symptoms.

The pathogen *Alternaria solani* showed typical early blight symptoms. These symptoms were brown to olvaceous brown conidiophores, with conidia having typical transverse and longitudinal septa. The description of the fungus agreed with the description given by Common Wealth Mycological Institute, Kew, Survey, England, Thus the pathogen causing early blight of tomato has been identified as *A. solani*. Successful pathogenicity of the fungus on tomato was proved following Koch’s postulates by inoculating the spore suspension.

Solid media was used to study the growth and morphological characteristics of *A.solani*. Morphological variability in colony, substrate, colour, margin of colony, topography of colony, colony growth and sporulation was observed. Among six isolates (AS1, AS2, AS3, AS4, AS5, AS6) the isolates AS2 and AS4 showed maximum growth on PDA medium respectively. Whereas AS1 AS3 AS5 and AS6 showed low growth on PDA medium. And two isolates namely AS1 and AS3 produced good sporulation

The hazards related to health and environment due to the extensive use of chemical pesticides for the disease control of important cereals crops urged for the implementation of biological control by using indigenous rhizobacteria. The use of plant growth promoting rhizobacteria is a multipurpose approach to protect plants from various soils borne pathogen.
Microbiological studies were conducted that indicates the characteristics of Plant Growth Promoting rhizobacteria. The soil samples were collected from tomato rhizosphere plant from Indian Institute of Vegetable Research Varanasi district Uttar Pradesh, India. A total of hundred soil sample were screened for the presence of beneficial bacteria. Preliminary identification test were carried out based on the formation of the characteristic antagonistic activity test, siderophore test phosphate solublizing test, Indole acetic acid production. Five isolates were selected based on their activities, on the basis of biochemical tests and some characterization, isolates were finally identified as *Pseudomonas sp.* *Bacillus sp.*, the isolates were further evaluated in the field on the basis of their characterization.

*In vitro* screening of fifteen isolates, six isolates showed antagonistic activity against *A. solani* with a variable range of percent inhibition, in which TR25 and TR21 showed strong activity against pathogen (*A. solani*) with a variable range of percent inhibition. All types of agricultural soils have some suppressive effect over several soil borne plant pathogens showing the antagonistic activities of the rhizobacteria inhibiting in soils. Furthermore these selected strains were undergoes various characterizations such as phytohormones like, iron providing chelating siderophore, phosphate solublization, ammonia production, HCN production and also had some enzyme activity such as catalase, oxidase property. On the basis of their characterization five isolates were selected in field evaluation.

Five isolates were further evaluated under field conditions for plant height, yield and reduction in PDI. The highest plant height was recorded in TR25 followed by TR24, T6, and T7 respectively and maximum yield was recorded in TR25 followed by T6 (Fenomidon +Mancozeb) and TR24, respectively and least diseased severity was also recorded in TR25 followed by TR24, T6 and T7 as compared to control.

On the basis of above discussion to improve plant height, reduction in disease incidence, and increased yield, TR25 (*Pseudomonas sp*) being ecofriendly and sustainable bio-fungicide. It was found that isolate strain can constitute the chemical fertilizer and can survive in the soils system to retain the activity potential for long time.
Conclusion

The present investigation would be concluded that out of six isolates of *A. solani*, two isolates namely AS1 and AS3 exhibited higher rate of sporulation and AS2, AS4, showed maximum growth on PDA media.

One hundred bacterial isolates were recovered from tomato rhizosphere, out of these, 15 isolates showed superior potential for plant growth promoting properties. Six PGPR (viz., TR15, TR18, TR21, TR22, TR24, and TR25) showed efficient antagonistic activity against *A. solani* tested through dual culture methods and strain TR25 revealed the highest antagonistic activity against *A. solani*

Under field condition isolate strain TR25 (*Pseudomonas* sp.) showed its role as potential antagonistic agent, reduced disease severity, increased crop yield and plant height in controlling early blight disease of tomato in comparison to chemical fungicide, the isolated strain TR25 (*Pseudomonas* sp.) can be alternative solution for routinely practiced chemical fungicides, as ecofriendly biocontrol agent for agricultural sustainability.