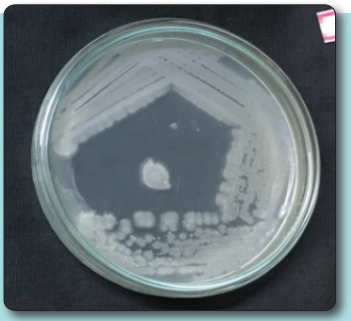
Bioformulation of *Bacillus subtilis* strain NBAIR BS1 for growth promotion



Nucleus culture of *B. subtilis* NBAIR BS1

Technology Description

Bacillus subtilis strain NBAIRBS 1 was highly inhibitory with maximum of inhibition zone against *Fusarium ambrosium* which is a major symbiont of tea shot hole borer *Euwallacea fonicatus*. *Bacillus subtilis* was identified by 16S rDNA analysis. *B. subtilis* was formulated in talc formulation and the shelf life of the formulation was 12 months. *B. subtilis* strain NBAIIBS1 induced the growth of tea plants by suppressing incidence of the tea shot hole borer. Application of talc formulation of *B. subtilis* strain NBAII BS1 in the form of spraying and drenching @10g/L was found effective in reducing 68 % tea shot hole borer incidence. Since *B. subtilis* is very good phosphate solubilizer it induced the growth of tea plants by increasing the root length, shoot length, number of tender leaves and stem girth *B. subtilis* improved the growth of tea plant when tea plants are stressed with shot hole borer.

Background

Laboratory studies proved that fungus *Fusarium ambrosium* is very essential in the insect diet for the survival and development of shot hole borer. It was found that in the absence of fungus, the shot hole borer failed to survive in the artificial diet. The production of ergosterol from the symbiont fungus was confirmed. The ergosterol is very important constituent for the fecundity of insect. The mutualistic association between the insect and fungal partners were established through the laboratory experiments. It was also established through the *in vitro* studies that the antagonistic microbe *Bacillus subtilis* highly inhibited the growth of the mutualistic fungus *Fusarium ambrosium* resulting in the mortality of SHB. Laboratory evaluation of antagonistic microbe *B. subtilis* on the SHB infested stems revealed that it killed the shot hole borer in 87.5 per cent stems by suppressing the growth of the symbiont *Fuasrium ambrosium*. The microplot experiments revealed that *Bacillus subtilis* performed well while applied as spray and drench over the branches and root zone respectively. Liquid and solid formulation of *Bacillus subtilis* were made and evaluated under larger plots. The large block trial confirmed that by blanket soil application and spraying of *B. subtillis* reduced the shot hole borer infestation by 68.5 per cent which was superior to all other treatments and increased the growth of tea plants and leaf

buds by 52 %. The growth of the tea plants was increased due to its root colonization and phosphate solubilization. Application of the organism *Bacillus subtilis* as spray and soil drench effectively suppressed the SHB through the suppression of its symbiont.

Benefits /Utility

The organism *Bacillus subtilis* suppressed the mutualistic *Fusarium* spp which is associated with tea shot hole borer. Finally the tea shot hole borer was suppressed by suppressing the mutualistic fungus *Fusarium.* Growth of tea plants is highly increased. Technology containing antagonistic organism *Bacillus subtilis* was adopted by the tea growers. This technology has great demand among tea growers for suppression of tea shot hole borer as well as improvement of growth.

Scalability

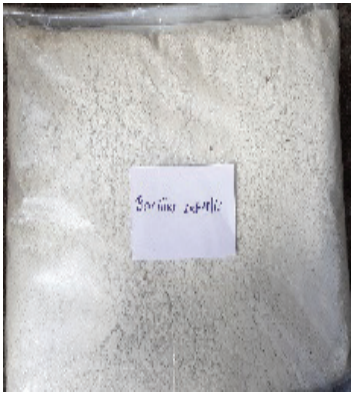
It can be scaled up to large quantities

Business and commercial potential

This organism helps the plant to uptake phosphorous which is very important for shoot and root growth. Since *Bacillus subtilis* boost the crop growth and yield it has a great demand and market potential

Financial requirement

An initial investment of Rs 10 to 15 lakh is required to establish infrastructures and other facilities to produce 100 tonnes of the product.



Talc formulation of *B. subtilis* NBAIR BS1

Spraying *B. subtilis* NBAIR BS1 in tea field

Target Market/Customer

Department of Agriculture and Horticulture, Biopesticide industries, Fertilizer manufacturers, non-Governmental organizations, Krishi Vigyan Kendras, State biocontrol laboratories, commodity boards, organic tea growers, tea nursery growers, State plantations. This technology already commercialized to one firm.

Social Impact of the Technology

- This technology will take care of plant, soil and human health. Dependence of chemical growth hormones and regulators will be highly reduced through the adoption of this eco-friendly technology. Since this organism is very easy to handle and produce large scale rural self-employment avenues could be created.

Toxicology data

- *Bacillus subtilis* NBAIR BS1 act as a growth promoter so toxicology data will not be required.