ASSESSING ANAEROBIC BACTERIA SURVIVAL IN DIFFERENT MICROBIAL INOCULANT PREPARATIONS TO USE IN SUSTAINABLE PADDY CULTIVATION IN DRY ZONE OF SRI LANKA

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Introduction

The increasing need for environmental friendly agricultural practices is driving the use of biofertilizers based on beneficial microorganisms. As such altering the rhizosphere micro flora by seed, soil or root inoculation with specific organisms is considered a sensible opportunity. Plant growth promoting rhizobacteria (PGPR) are heterogeneous group of bacteria that can be found in rhizosphere and in association with roots which can improve the quality of plant growth (Biswas *et al.*, 2000). The development of techniques for the production of large quantities of microbial inoculants with high potential of infectivity and consistent effect under field conditions are the main issues to be tackled because of their wider use as biofertilizers. "Jeewamurthum" is the microbial inoculant prepared with the use of organic ingredients which supply suitable nutrients to facilitate the growth and activity of consortia of native microorganisms present in the added soil. As such "jeewamurthum" is a liquid microbial inoculant which enhances the native microbial population and diversity upon addition to the particular soil. Further, it was hypothesized that the increased size and diversity of the bacterial populations synergistically influence on increased plant nutrient availability in paddy soil after addition. Therefore, the choice of the soil used for inoculant production is one of the key aspects to their successful application. Hence the present study was carried out with the aim of comparing anaerobic bacteria community composition in different "jeevaamurthum" formulations with three different soils taken from wetland, paddy field and the field which was not used to cultivate paddy this season, but cultivated on previous season. Since paddy fields of Sri Lanka are often in flooded conditions, flooded soils considered as microbial inoculants and anaerobic bacterial population counts were assessed.

Methodology

Soil samples were collected from the surface (0-15 cm) depth from three locations as wetland, paddy field and the field which was not used to cultivate paddy this season, in Anuradhapura, Sri Lanka. Anuradhapura is located in the North

Central province of the dry zone in Sri Lanka. Average annual rainfall is 1665.4 mm. and the mean temperature is 28.5 °C. From each location soil samples were collected randomly and mixed thoroughly to get a homogeneous mixture. The experiment was planned as Randomized Complete Block Design (RCBD) with three treatments and six replicates in each. About 500 g of the each soil sample was used for the preparation of "jeewaamurthum." In addition to the soil, cow urine, cow dung, sugar, *Gliricidia* leaves and water were mixed and allowed to be fermented by anaerobic bacteria of the particular soils respectively. Maintaining anaerobic conditions facilitated the growth of anaerobic bacteria in the mixture. Total anaerobic bacterial counts (CFUs) in 1 g of each "jeewaamurthum" samples were determined by following standard total plate counts incubated at room temperature under anaerobic conditions. Bacterial diversity is also assessed. In each treatment 1, 3,5, 7, and 15 days of anaerobic incubation bacterial counts were estimated. Data were statistically analyzed by using Minitab 16 software package. Analysis of variance was taken by fitting General Linear Model.

Results and Discussion

According to fitted General Linear Model considering three different "jeewaamurthum" formulations there was significant treatment effect (P=0.014). Considering the grouping Bonferroni method used and 95.0% confidence it was shown that "jeewaamurthum" which was prepared with wetland soil has different grouping and highest mean than the other two treatments. Anaerobic bacterial diversity is also significantly high in the "jeewaamurthum" prepared with wetland soil (P=0.032). Considering both treatment and the day of incubation the response was not significant (P>0.05).The reason might be the wetland soil which contrasts to the soils of other two locations is not subjected to paddy cultivation for a longer time period. Hence the wetland soil is not subjected to inorganic fertilizer, herbicide and pesticide application by farmers. Inorganic inputs in agriculture adversely affect soil microbial population and diversity (Bunemann*et al.*, 2006). Further it was shown that anaerobic bacterial population count in all three "jeewaamurthum" formulations were increased with days of incubation even in fifteenth day of preparation.

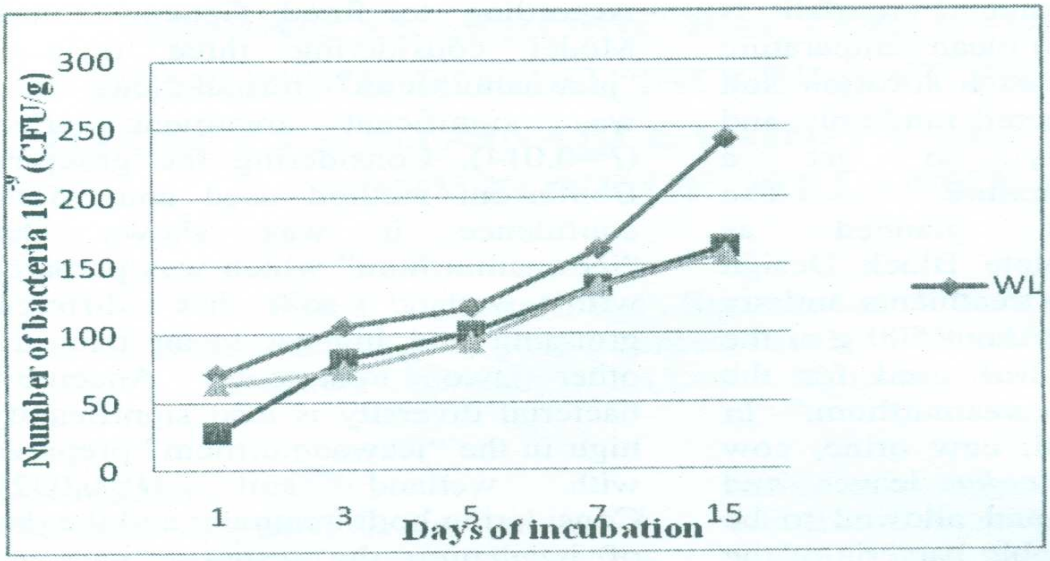

Figure 1: Mean anaerobic bacterial counts (CFU/g) of the "jeewaamrthum" preparations with soils collected from wetland, paddy field and the field which was not used to cultivate paddy this season, in different days of incubation (WL- wetland; PF- paddy field; PFNC- paddy field without cultivation).

Conclusions

"Jeevaamurthum" preparation with undisturbed wetland soil has more potential to augment native anaerobic bacteria to the paddy fields under flooded conditions in dry zone of Sri Lanka. Further, such consortium of anaerobic bacteria can be further formulated based on concentrations and can be designed for large scale production with inoculation of the suitable organic carrier substances in order to use in sustainable paddy cultivation practices.

References

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