

BIOFILM EXUDATES RESUSCITATE VIABLE-BUT-NON CULTURABLE BACTERIA IN PADDY ROOT-ZONE SOIL

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Microbes become dormant with low levels of metabolic activity in response to stress, known as viable but nonculturable (VBNC). Biochemicals exuded from developed microbial biofilms (BFEx) have been reported to trigger metabolic activity of VBNC microbes. The present study aimed to evaluate the potential of BFEx on resuscitation of VBNC bacteria live in paddy root-zone soil. A field experiment was conducted during 2023/2024 *Maha* (wet) season in paddy fields across Anuradhapura, Polonnaruwa, Ampara, and Puttalam districts of Sri Lanka. Four fertiliser treatments: (a) BOMF practice (500 kg BOMF NPK ha⁻¹ + 2.5 L BFBF ha⁻¹), (b) hybrid practice (225 kg BOMF PK ha⁻¹ + 62.5 kg CF N ha⁻¹ + 2.5 L BFBF ha⁻¹), (c) chemical fertiliser (CF) practice (340 kg CF NPK ha⁻¹, as per the Department of Agriculture recommendations), and (d) control (no fertiliser) were applied in 100 m² plots using RCBD design with three replicates per treatment. Soil samples from each plot were serially diluted and plated on nutrient agar, with and without the addition of 10 µL sterile BFEx per plate and incubated at 37 °C for 24 hours to enumerate bacterial colonies. The difference in colony counts with and without BFEx was taken as a proxy for reactivated VBNC bacteria. One-way ANOVA followed by Tukey's HSD test was performed to compare the means. The results indicated that the breaking of dormancy of VBNC bacteria was significant in Polonnaruwa ($p < 0.05$), while it was not significant in Anuradhapura ($p = 0.124$), Ampara ($p = 0.275$), or Puttalam ($p = 0.078$) at 5% significance level, although a trend was observed. In conclusion, the findings suggest that BFEx has the potential to resuscitate VBNC bacteria in paddy root-zone soil, although this effect appears to be location-specific. Further studies are needed to elucidate the species-specific mechanisms underlying this resuscitation.

Keywords: Biofilms, Rice, Soil microbes, VBNC