

The phylogenetic changes in diazotrophic population under butachlor application in paddy soil

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ABSTRACT

Butachlor, [(*N*-(butoxymethyl)-2-chloro-2',6'-diethylacetanilide)], a pre-emergence herbicide, is used extensively in paddy fields. In the research, the populations and the species of culturable diazotrophs upon 15 g are⁻¹ of butachlor application were examined. The results have confirmed the raise in diazotrophic population by butachlor application. The taxonomic distribution was also changed by butachlor. γ Proteobacteria was the dominant taxa under butachlor application after 7 days or rice planting in the upper layer soil. But after 39 days, α Proteobacteria and Actinobacteria were also isolated. β -Proteobacteria and Actinobacteria were the dominant taxa under butachlor application after 7 days in the lower layer soil. But after 39 days, α Proteobacteria was also isolated from the medium. The results indicated the population as well as the taxonomic changed upon butachlor application, which were both contributed the raise in soil nitrogen fixation ability in the paddy soils.

Keywords: butachlor, diazotroph, nitrogen fixing ability

INTRODUCTION

Butachlor, [(*N*-(butoxymethyl)-2-chloro-2',6'-diethylacetanilide)] (Figure 1), a pre-emergence herbicide in paddy fields, has been confirmed of the high efficiency of weeds killing and rice production boosting effect. Many reports about stimulatory and inhibitory effects on nitrogen fixation ability by butachlor application in rice rhizosphere have also been reported. Our previous research showed the application of butachlor imposed a significant variation on culture-independent microbial community shift (Chen et al., 2009). In this study, populations of culturable diazotrophs as well as the taxonomic distribution of them were examined for further understanding the reason of the augment of nitrogen fixing ability in paddy fields upon butachlor application.

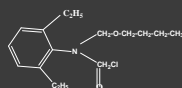


Figure 1. The chemical structure of butachlor

MATERIALS AND METHODS

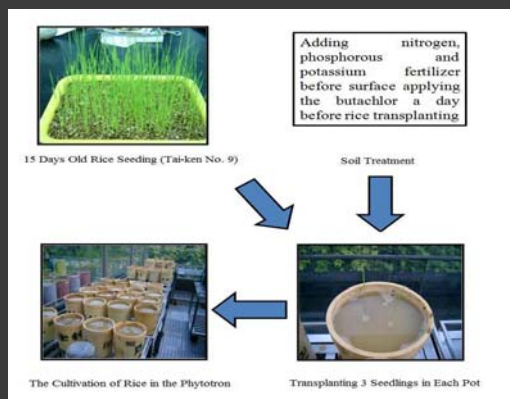


Figure 2. The rice planting process, 15 g are⁻¹ of the butachlor were surface applied a day before rice transplanted

RESULTS AND DISCUSSION

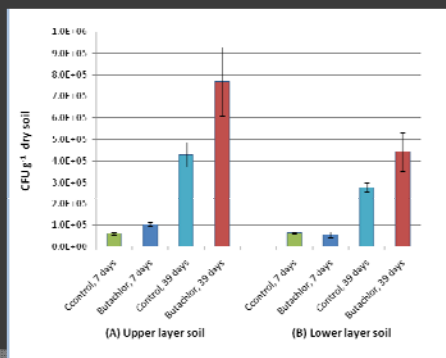


Figure 3. Effect of 15 g are⁻¹ butachlor application on number of potential diazotrophic bacteria after 7 and 39 days of rice cultivation in (A) upper layer soil (0-3 cm) and (B) lower layer soil (3-15 cm).

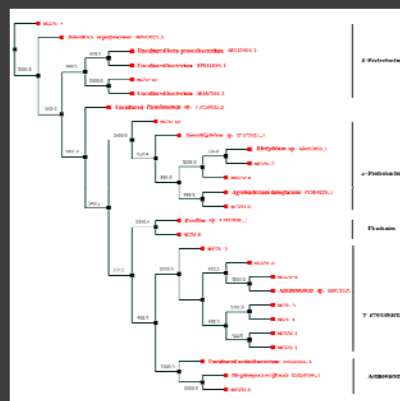


Figure 4. Phylogenetic analysis of potential diazotrophs in 0-3 cm paddy soil. (Numbers at the forks indicate the times of the group consists the species from 1000 replicates of bootstrap analysis)

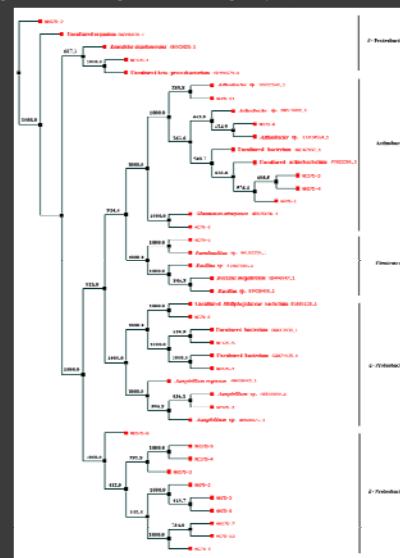


Figure 5. Phylogenetic analysis of potential diazotrophs in 3-15 cm paddy soil. (Numbers at the forks indicate the times of the group consists the species from 1000 replicates of bootstrap analysis)

CONCLUSION

The taxonomic distribution was changed upon butachlor application. The boosted of the nitrogen-fixing ability could be result of both the population as well as the species alteration.

LITERATURE CITED

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