



Dissipation of chlorantraniliprole in contrasting soils and its effect on soil microbes and enzymes

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ABSTRACT

An experiment was set up to determine the rate of dissipation of chlorantraniliprole (CTP) from two soils with contrasting properties. The other objective of the study was to find out the effect of CTP on soil microorganisms (population, microbial biomass carbon and soil enzymes) under controlled environment. CTP residues when applied at recommended dose ((RD) (at 40 g a.i./ha)) could not be recovered either from alluvial soil or red soil at 60 days post application of CTP in a microcosm study. Higher clay content led to higher half-life in alluvial soil compared to red soil. CTP could not be recovered from RD treatment at 30 days after pesticide application under controlled environment. Faster dissipation of CTP was observed in rice rhizosphere soil with 23.89 and 34.65 days dissipation half-lives for RD and double the recommended dose (DRD) treatments, respectively. Different doses of chlorantraniliprole did not have considerable negative effect on actinomycetes, fungi, biological nitrogen fixers and phosphate solubilising bacteria except the bacteria population. Among the treatments, DRD recorded the lowest activity of dehydrogenase, fluorescein diacetate hydrolase, acid and alkaline phosphatases followed by RD treatment. Microbial biomass carbon, β -glycosidase and urease did not vary significantly among the different doses of CTP. In general, RD did not have negative effects on soil microbes. Hence, CTP can be recommended in rice pest management maintaining existing soil microbes and soil enzymes activity.

1. Introduction

Among the major cereal crops, rice consumes significant amount of pesticides as it is widely cultivated in more than 160 million hectares worldwide (Pathak et al., 2018). Application of pesticides controls number of insect-pests and diseases to minimize the losses of rice production. Chlorantraniliprole (CTP) belongs to the group of anthranilic diamide insecticide, and is effective against lepidopteran, coleopteran, dipteran, and hemipteran pests and acts on ryanodine receptors of insect (Lahm et al., 2007). Two formulations namely, chlorantraniliprole 0.4 G at 10 kg ha⁻¹ and chlorantraniliprole 18.5 SC at 150 mL ha⁻¹ are recommended for management of yellow rice stem borer and leaf folder (CIB&RC (DPPQS), 2018; Lahm et al., 2005). The insecticide has been preferred for its low mammalian toxicity, low toxicity to non-target arthropods and other organisms. The Environmental Protection Agency (EPA) has classified chlorantraniliprole as a reduced risk pesticide.

Along with the properties of pesticides, soil properties influence the dissipation of pesticides (Bending et al., 2006). Physico-chemical properties of soils differ from region to region depending on the parent

material and prevailing climate conditions. They will have significant effect on dissipation of any pesticides. Therefore, dissipation studies are necessary to understand its persistence in a particular ecosystem and its interaction with soil properties. CTP is one of the most extensively used insecticides in rice cultivation in South Asia. However, no information is available on build-up of residues in rice soil and alteration of soil biochemical properties on its use. Studies related to role of soil properties on CTP degradation are also limited. Soil is a dynamic living system with a variety of micro and macro flora and fauna including soil microorganisms. Microbial biomass and soil enzyme activities respond very quickly to changes in crop management practices or environmental conditions (Dick, 1994). Soil microbes and enzymes play critical role in nutrient cycling and also biodegrade different pesticides. Till date limited studies have been undertaken to know the role of CTP in granular formulation on soil microorganisms.

Soil enzymes involved in soil carbon, nitrogen and phosphorous cycles should be measured to indicate the influence of CTP on these enzyme activities. This study will generate basic information about the safe use of CTP in rice pest management and its effect on soil. So, we

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