

Research Paper :

Quantification and toxic effects of phenolic acids on paddy seedlings in paddy soil

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ABSTRACT

Laboratory incubation conducted to study the toxic effect of decomposition of Parthenium and Chromolaena and their respective compost under flooded condition. Increasing the level of organic carbon application through different sources increased the water extractable phenols, water insoluble alkali extractable phenols and total extractable phenols. The contents of the three forms of phenols increased from 15th to 45th day of flooding and then decreases. Plant height and root length was maximum during sixty days after flooding with the incorporation of organic manures.

Key words : Parthenium, Chromolaena, Phenols, Phytotoxicity, Organic manure

Rice soils are unique in their physico-chemical, electro-chemical, biochemical and microbiological properties, when compared to a normal aerable soil. Organic materials incorporated to flooded rice soils during anaerobic decomposition produce intermediary products, which are biologically active and final products are gases. Accumulation and toxicity of intermediary products to rice plants has ill effects on crop production. In this context a laboratory experiment was conducted to know the toxic effect of decomposition of Parthenium and Chromolaena and their respective composts under flooded soils.

MATERIALS AND METHODS

Soil samples were collected from Mudigere paddy soil belongs to Typic Paleustalf. 20 g soil samples were thoroughly mixed with 0.5, 1.0 and 2.0 per cent level of organic carbon of organic materials *i.e.* Parthenium and Chromolaena and their respective composts in 100 ml capacity glass test tubes. After thoroughly mixing the organic material with soil, distilled water was added to the test tubes so as to maintain standing water of 3 cm above soil. Test tubes were sampled at periodic intervals and subjected to analysis for the production of toxic substances like water extractable phenols (WEP), water insoluble alkali extractable phenols (WIAEP), total extractable phenols (TEP) (Sadasivam and Manickam, 1992). To study the effects of decomposition products on growth of paddy seedlings, the soil from the incubation experiment was used for bioassay study with pre germinated paddy seeds. Biometric observation like plant height and root length was taken. Also the impact of graded levels of organic matter in terms of phytotoxicity was studied.

RESULTS AND DISCUSSION

High amounts of phenolic acids could be extracted from soils receiving organic manures. Large proportions of the alkali extractable phenolic acids were in water soluble form and hence could be extracted with distilled water (Table 1). Easily decomposable organic manures like Chromolaena compost and Parthenium compost showed sharp increase in phenol content on 15th day of flooding. With time, the content of water insoluble forms of phenolic acids increased in all organic manure treated soils. Occurrence of phenolic acids has been reported in paddy soils (Mortia, 1981; Rao *et al.*, 1975) and in cultivated soils of temperate conditions (Whitehead, 1964; Wang *et al.*, 1967). However, addition of Parthenium and Chromolaena as green manure to soils under anaerobic conditions increased the total phenolic acid production (Tsutsuki and Ponnampereuma, 1978). In the present study, the amount of phenolic acid produced was directly related to the degree of decomposability. In certain mature peat soils under cultivation, free form / water soluble form will be lesser than unextractable / bound form of phenolic acids (Katase, 1983 ; Katase and Kondo, 1989).

Wide variation was noticed with respect to the type of phenolic acids produced in different organic manures incorporated soils (Table 2). Phenolic acids such as p-coumaric acid, p-hydroxybenzoic acid, syringic acid and vanillin are common intermediate products of native soil organic matter degradation and added organic manures (Yadav, 1990; Raina and Goswami, 1988). Among the phenolic acids quantified, small quantities of vanillin was detected at 30th day of flooding when compared to the remaining three acids. This might be due to the susceptibility of vanillin to microbial degradation (Martin