DEGRADATION OF CARBOXIN AND OXYCARBOXIN IN DIFFERENT SOILS*

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KEY WORDS

Adsorption Carboxin Degradation Desorption Oxycarboxin Persistence

SUMMARY

Five different soils varying in physico-chemical properties were used for studying the persistence and degradation of carboxin and oxycarboxin. In one soil only both fungicides were degraded with accumulation of ammonium and nitrite. Under the conditions of forced circulation of air and continuous perfusion, oxycarboxin was found to be more susceptible to degradation than carboxin. Under simulated conditions of rice fields, conversion of carboxin to its sulphoxide and to a non-toxic derivative of oxycarboxin could only be seen in all the soils.

The role of clay, humus and organic matter as protectants of fungicides against degradation indicated that the intermediary compound carboxin sulphoxide was strongly adsorbed probably on organic and inorganic colloids of most of the soils. Organic matter free soils delayed the degradation. Carboxin was rapidly converted to its sulphoxide on three forms of monoionic clays whereas oxycarboxin was transformed to an unidentified derivative.

INTRODUCTION

Although, a number of soil microorganisms are known to rapidly detoxify the pesticides in pure cultures, the same pesticide when applied to soil appear to persist for a considerable length of time despite the known presence of microorganisms capable of degrading them. Persistence of the pesticides or delayed detoxification appears to depend on the differences in the physico-chemical properties of the soil, as well as, environmental factors as pH, moisture content, temperature etc. An attempt was made to examine the metabolism of two systemic fungicides viz, carboxin and oxycarboxin, when applied to different types of soil.

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MATERIAL AND METHODS

Degradation in incubated soils

Five different soils, viz, red sandy loam soil of Hebbal, black clayey soil of Dharwad, laterite soil of Mangalore, saline alkali soil of Nargund and coffee plantation soil of Coorg were used. Their physical and chemical properties are given in Table 1. Carboxin and oxycarboxin (obtained from Uniroyal Chemical, Bethany, Connecticut, USA) were applied to the soils at three levels, viz, 100, 1000 and 10,000 ppm. Moisture was adjusted to 60 per cent of the maximum water holding capacity. Appropriate controls were included. They were placed in plastic dishes and incubated at 28 ± 2°C. Samples were withdrawn at monthly intervals up to one year and assayed for the products of degradation after extracting with chloroform colorimetrically. Bioassay tests were carried out on PDA plates seeded with *Rhizoctonia solani*.

Degradation in continuously perfused soils

The soil columns for perfusion were prepared by placing 50:50 mixture of each soil and fine quartz with a wad of glass wool at the bottom and at the top of the perfusion tubes. The soils were continuously perfused with the aqueous solutions containing carboxin at 170 ppm and oxycarboxin at 1000 ppm (their maximum solubilities in water) for a period of four weeks. Compressed air was used to force the liquids through the columns. At intervals, the perfusates were extracted with chloroform and chromatographed on thin-layer silica gel plates. The degradation under flooded condition was carried out according to Sethunathan and the products of degradation were detected on thin-layer chromatoplates.

Soils denuded of organic matter (by heating the soils with hydrogen peroxide) were treated with the fungicides to a concentration of 100 ppm and were incubated at 28°C ± 1°C. Samples were extracted periodically with chloroform and the products of degradation were detected as before.

Adsorption and desorption of the fungicides in different soils were carried out according to Grover. The presence of the fungicides from the adsorbed or desorbed solutions was tested according to Lane. Induced hydrolysis if any, of the two fungicides due to adsorption, was studied on three forms of monoionic kaolinite clays, viz, Na, Ca and H which had cation exchange capacity of 11.2 meq, 11.8 meq and 11.3 meq/100 g of clay and pH of 7.2, 7.4 and 5.0 respectively. The procedure described by Saltzman et al. was used.

Analytical methods

Ammoniacal, nitrite and nitrate nitrogen were estimated according to Bremner. Silica gel plates were developed in chloroform. Aminophenol on the chromatoplates were detected by spraying with Folin-phenol reagent and sulphoxides by spraying with chloroplatinate reagent. Other spots were detected by spraying with 0.01% fluorescein in methanol and observing under ultraviolet light.

RESULTS AND DISCUSSION

Carboxin underwent rapid degradation to its sulphoxide within ten days in all the soils. With both the fungicides, aminophenol could be detected at the end of eight months in red sandy loam soil and after six months in coffee plantation soil.