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Clopyralid uptake of contaminated compost-fertilised corn

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Key words : clopyralid, compost, corn, LC/MS/MS analysis

Introduction It has been reported (Sato, 2006) that the cases uncertain cause abnormal growth in horticultural crops (e.g. tomato eggplant) is generated. In the present investigation, clopyralid (3,6-dichloropyridine-2-carboxylic acid, Figure 1) was detected in cow excrement compost and its materials feeds. Clopyralid is not registered as an agricultural chemical in Japan. It is uncertain how the chemical was detected in Japan despite not being used. Gramineous plants have low sensitivity for clopyralid. So, there is the possibility of circulation in the food chain (i.e. imported feed-cattle-fescue-compost-corn). To clarify the likelihood of the circulation, the effect of fertilizing a clopyralid-contaminated compost on the clopyralid uptake of corn was investigated someone two different soil types.

Materials and method The corn seed was sown in the plastic pots (L560 mm, S260 mm, H170 mm) filled with the soil, compost and activated carbon (Wako Pure Chemical Industries, Ltd Osaka, Japan). The details are summarized in Table 1 (one seed per pot, with each treatment being performed in triplicate). The concentration of clopyralid in the compost was 73 µg/kg. Corn was grown in the greenhouse for 65 days, being kept at 20-30°C. Sampling was carried out just before the heading stage at least 5 cm above the soil. Corn samples were cut at 5-10 cm, mixed, and the 30 g of FM were used for the clopyralid quantified analysis by LC/MS/MS.

Table 1 Experiment treatments for measuring uptake of clopyralid from the soil to the corn.

No.	soil type	soil amount (kg/pot)	clopyralid-contaminated compost amount (t/10a)	activated carbon amount (t/10a)
1	andosol	20	0	0
2	andosol	20	3	0
3	andosol	20	10	0
4	andosol	20	10	1
5	sandy soil	20	10	0

Results and discussion The results of the uptake experiment are shown in Figure 1. Clopyralid was not detected (< 2 ng/g FM) in the corn grown in soil without clopyralid contaminated compost (T1). This result showed that there was uptake of clopyralid via air. Clopyralid was detected in the corn grown used clopyralid contaminated compost for fertilizer (T2-T5). When compared to T2, the amount of clopyralid in the corn was 2.3 times higher in T3. Since T3 applied 3.3 times as much clopyralid as T2, it would suggest that the amount of clopyralid in the corn is dependant on the amount of clopyralid-contaminated compost, at the concentration level used here. The addition of active carbon (T4) lowered the amount of clopyralid uptake in the corn relative to T3. The amount of clopyralid in the corn grown in the sandy soil (T5) was much higher than that in andosol (3). Two causes of this are conceivable: 1) the difference in the adsorption ability of the soil, and 2) the difference in the activity of microorganisms in soil that break down clopyralid.

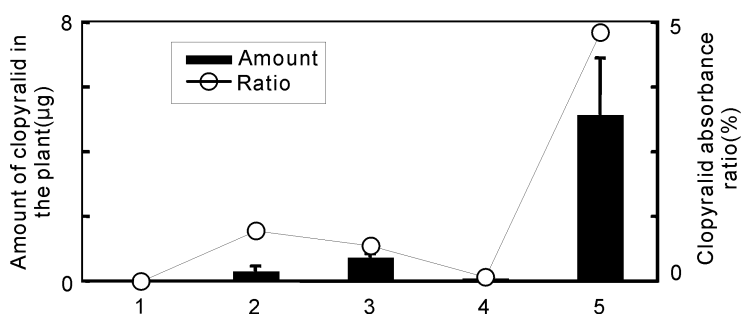


Figure 1 Amount of clopyralid in the corn (bar; left scale). Ratio of uptake of clopyralid (sequential line; right scale). Error bars shows standard deviation.

Conclusion The uptake of clopyralid to corn was dependant on compost fertilization rates and the nature of the soil. Thus, the possibility of the circulation is also varying according to the nature of the soil.