



Does composting degrade modified DNA?

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Introduction

Organic farmers sometimes rely on neighbors who farm conventionally to supply manure for compost. Conventional livestock farmers use feed which usually contains genetically modified plant materials. Organic products must be free of genetically modified materials.

The aim of this study was to test feed, manure and compost from four farms in Nova Scotia for the presence of genetically modified DNA sequences. The four farms included an organic farm with poultry layers, a dairy farm in transition to organic production, a conventional dairy farm and a conventional poultry layer facility.



Conventional poultry layer



Conventional dairy cow

Materials & Methods

Feed and manure samples were collected from four farms in Nova Scotia. Manure was mixed with waste hay to increase the C:N ratio. Composting was done in wire bins and was turned using dedicated forks. Vermicompost was prepared by Glen Munroe using the manure plus hay and peat moss. Samples were collected every four weeks for 16 weeks from both types of compost. Finished compost from three commercial operations were also evaluated.

Samples were air-dried, then ground in liquid nitrogen. DNA was extracted using a CTAB incubation, then a chloroform extraction, followed by precipitation in isopropanol. DNA was redissolved in TE buffer with RNase. DNA integrity was evaluated by electrophoresis on 0.8% agarose gels.

PCR primer pairs were chosen to amplify regions of the 35S promoter and the *Nos* terminator. These two sequences are commonly found in genetically modified plants. GM corn and soybean seedlings provided positive controls while non-GM plant were negative controls. The PCR procedure included 35 cycles consisting of a 1 min denaturation step at 95 C, a min annealing step at 55 C, and a 1 min extension step at 72 C. Amplified DNA was separated on 2% agarose gels and stained with ethidium bromide.

Results & Discussion

Results of tests for modified DNA sequences are provided in the table below.

The 35S sequence was more prevalent in manure and compost than the *Nos* sequence and may be less susceptible to degradation or there may have been a problem with the *Nos* primers.

Modified DNA sequences were detected in feed samples from the organic poultry farm as well as feed samples provided by other organic farmers.

Modified DNA sequences were not detected in the organic dairy feed.

Table 1. Results of tests for presence of two modified DNA sequences in feed, manure, compost and vermicompost.

Sample	N	Modified sequences	
		35S (101 bp)	<i>Nos</i> (151 bp)
Organic dairy			
Feed	4	0	0
Manure	4	0	0
Compost	4	0	0
Vermicompost	4	0	0
Organic Poultry			
Feed	8	6	0
Manure	4	0	0
Compost	4	0	0
Vermicompost	4	0	0
Conventional dairy			
Feed	4	4	4
Manure	4	1	0
Compost	12	0	0
Vermicompost	6	0	0
Conventional poultry			
Feed	5	5	5
Manure	9	3	0
Compost	15	3	0
Vermicompost	8	2	0
Other			
Organic composts	10	0	0
Organic feeds	7	4	1

Modified DNA sequences were not detected in any of the organic manure or compost samples.

Modified DNA sequences from the 35S promoter were detected in samples from conventional dairy and poultry manure. The *Nos* sequence was not amplified in any manure samples. Two additional primer pairs, specific to the *Nos* region, with 125 and 180 bp amplification products, were later evaluated and provided more positive results than the original *Nos* primers.

All samples of conventional dairy compost and dairy vermicompost were negative for the modified DNA sequences.

Conventional poultry compost and vermicompost tested positive for the 35S modified DNA sequence. Two of the positive compost samples were from 3-month-old compost. Vermicompost tested positive at 4 months.

A possible explanation for the presence of modified DNA in poultry compost and absence in dairy compost relates to the fact that the poultry manure sample was contaminated with uneaten feed while the dairy manure was free of feed.

No modified DNA sequences were detected in 4-month-old compost. This is encouraging, however, the compost was prepared in small lots with frequent turning. It is possible that modified DNA sequences might persist longer in compost that is prepared under less favorable conditions.

Conclusions

A 35S modified DNA sequence was detected in composted manure from poultry layers fed diets containing genetically modified plant materials up to three months after composting was initiated and in vermicompost at 4 months.

The results indicate that if composting is done well, modified DNA can be degraded in four months. There is concern that modified DNA may persist longer under less favorable composting conditions.

Vermicomposting appears to be inefficient at degrading modified DNA.

Additional research will investigate the integrity of the modified DNA extracted from manure and compost.

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