

Feeding TH 6040 to Cattle: Residues in Tissues and Milk and Breakdown in Manure

Three dairy cows were fed Thompson-Hayward TH 6040 [*N*-(4-chlorophenyl)-*N'*-(2,6-difluorobenzoyl)urea] at rates ranging between 0.25 and 16 mg/kg body wt per day for 4–5 months. No (<0.02 ppm) TH 6040 was found in the milk of the cow fed as much as 8 mg/kg body wt, and even when 16 mg/kg body wt was fed, only 0.02 ppm was found in the milk. The maximum residue found in the body fat of this cow was 0.25 ppm. TH 6040 in the manure (exposed outdoors) of a cow fed 0.25 mg/kg body wt decreased over time at a rate described by a hyperbolic curve; the half-life was 4–5 days.

Thompson-Hayward TH 6040 [Dimilin, *N*-(4-chlorophenyl)-*N'*-(2,6-difluorobenzoyl)urea] is an insect growth regulator that interferes with the formation of the insect cuticle (Mulder and Gijswijt, 1973). Miller (1974) reported that the feeding of 0.25 and 1.0 mg of TH 6040/kg body wt to dairy cows gave good (>95%) control of larvae of the face fly, *Musca autumnalis* De Geer, and the house fly, *Musca domestica* L., respectively, seeded into the resulting feces. Corley et al. (1974) found no (<0.1 ppm) residues of TH 6040 in the milk of a cow fed the compound at a rate of 1 mg/kg body wt over a 15-week period. Pickens and Miller (1975) reported that TH 6040 adversely affected nontarget insects in the feces of cows fed the compound.

The objectives of the present study were to determine whether TH 6040 accumulated in the tissues of cattle and whether residues could be detected in the milk of a cow fed increasing rates of TH 6040. Also, we were interested in the breakdown of TH 6040 in manure exposed outdoors.

MATERIALS AND METHODS

Three cows were fed an air-milled technical formulation of Dimilin as follows: Cow 1652 was fed Dimilin at a rate of 1 mg/kg body wt from Oct 2, 1973, until Jan 29, 1974. Cow 5036 was fed rates increasing from 1 to 8 mg/kg body wt for 2-week periods starting June 1, 1974; then on July 27 the rate was increased to 16 mg, which was fed until the cow was slaughtered Oct 29, 1974. Cow 5086 was fed Dimilin at a rate of 0.25 mg/kg body wt from June 29, 1974, until Oct 30, 1974. The ration for these cows consisted of a corn silage-concentrate complete feed plus a limited amount of alfalfa hay. The Dimilin for each cow for each day was weighed out and premixed with ca. 200 g of dairy concentrate. This premix was added on top of the complete feed once a day.

Milk samples were taken from cow 5036 after each increase in rate and analyzed as described previously (Corley et al., 1974). However, when the rate was increased to 8 and 16 mg/kg body wt, the sample size was increased from 100 g to 200 and 800 g, respectively. Using these larger sizes, the cream was allowed to separate, then siphoned off and extracted separately from the milk, which was extracted by the regular procedure. Ethyl acetate extracts from the cream and the milk were then combined into one sample. We previously reported (Corley et al., 1974) that using a wavelength of 254 nm, the lowest detectable level of TH 6040 was 10 ng. In the present work, at a wavelength setting of 220 nm, 5 ng could be detected.

A 1-day collection of manure from cow 5086 (fed 0.25 mg/kg body wt) and cow 5036 (fed 16 mg/kg body wt) was taken to the laboratory, mixed in a Hobart mixer, and then fashioned into a large pat on a concrete slab and exposed to outdoor conditions. A slice (ca. 200 g) from the pat was taken every 5 days during a total period of 40 or 45 days. These samples were brought to the laboratory and frozen at 0 °C for later analysis of TH 6040. At the time of the analysis, 50 g of feces (10 g of the feces from 5036) was mixed with 100 g of sodium sulfate and extracted by

Table I. Residues (ppm) of TH 6040 in Tissues of Cows

Tissue	Cow 1652, ^a College Station	Cow 5036	
		Beltsville	College Station
Renal fat	None	0.20	0.10
Omental fat	0.10	0.20	0.10
Diaphragmatic fat	None	0.25	0.10
Subcutaneous fat	None	0.20	0.10
Heart	None	None	None
Muscle	None	None	None
Kidney	None	None	None
Liver	None	0.13	0.10

^a Analysis of tissues from this cow performed only at College Station.

blending with 150 ml of ethyl acetate. The material was then analyzed by the procedure used to analyze milk (Corley et al., 1974). When TH 6040 was added to untreated feces at levels of 0.1, 0.5, and 1.0 ppm, recoveries averaged 94%. Dry matter of the feces was determined by placing 50 g of feces in a forced air oven overnight and then reweighing.

Each cow was slaughtered on the final day of feeding the compound. Kidney, liver, heart, muscle, renal fat, omental fat, diaphragm fat, and subcutaneous fat samples were collected and frozen for later analysis of residues. The fat and tissue samples were analyzed for TH 6040 at both Beltsville, Md., and College Station, Tex. The analysis performed at Beltsville was essentially that previously described for milk: 50-g samples were blended with 100 g of sodium sulfate and 200 ml of ethyl acetate. When TH 6040 was added to untreated fat samples at levels of 0.1, 0.5, and 1.0 ppm, and to muscle tissue at 0.1 and 0.5 ppm, recoveries averaged 93 and 94%, respectively. The lower limit of detection was 0.1 ppm.

The method used for analysis at College Station was that described for manure by Oehler and Holman (1975) except that hexane rather than acetonitrile was used for the extractions. Recoveries of TH 6040 added to fat and muscle samples at a level of 5 ppm averaged 89 and 94%, respectively. In this laboratory the lower limit of detection was also 0.1 ppm.

RESULTS AND DISCUSSION

The feeding of Dimilin did not have any adverse effects on the cows that could be observed during the feeding period. Cow 5036, which was fed the highest levels, was observed to consume the premix containing Dimilin without hesitation.

No residues (<0.02) of TH 6040 were detected in the milk from cow 5036 during the period when 8 mg or less/kg body wt was fed. However, when the rate was increased to 16 mg/kg body wt, a trace of TH 6040 was detected, and when the sample size was increased to 800 g, 0.02 ppm was detected.

Figure 1 shows that the amount of TH 6040 present in the manure of the cow fed 0.25 mg/kg body wt (exposed

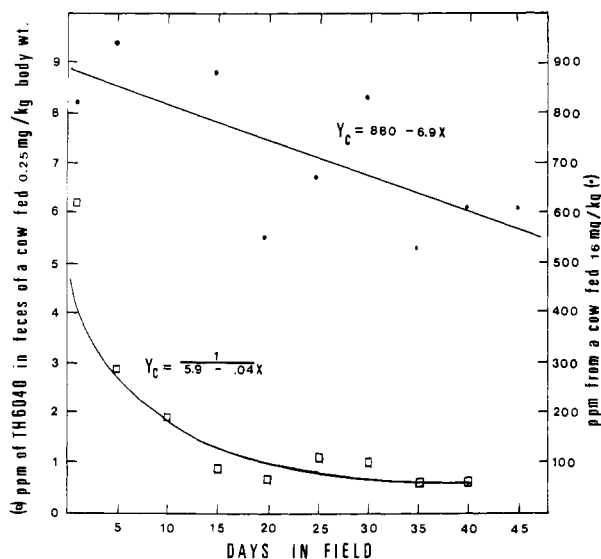


Figure 1. Breakdown over time outdoors of TH 6040 in manure from cows 5086 and 5036.

outdoors) decreased over time at a rate described by a hyperbolic curve; the half-life was ca. 4-5 days. The TH 6040 in the feces from the cow fed 16 mg/kg did not follow this pattern: the amount decreased somewhat over time, but over one-half the original amount was still present at 45 days.

The residues of TH 6040 in the fat and tissue samples from the cows fed the two highest rates are shown in Table I. These values are not corrected for recovery percentages. Only the omental fat of cow 1652 had residues as high as 0.1 ppm, but residues were detected in all four fat samples and also in the liver of cow 5036. The analyses at Beltsville

for cow 5036 indicated somewhat higher amounts of TH 6040 though all levels were at or near the lower limit of detection. The explanation may be the larger sample size used at Beltsville. In any case, the level of TH 6040 fed to cow 5036 is ca. 16 times more than is needed for control of the house fly and 64 times more than is needed for control of the face fly.

LITERATURE CITED

- Corley, C., Miller, R. W., Hill, K. R., *J. Assoc. Off. Anal. Chem.* 57(6), 1269-1271 (1974).
 Miller, R. W., *J. Econ. Entomol.* 67(5), 697 (1974).
 Mulder, R., Gijswijt, M. G., *Pestic. Sci.* 4(5), 737-745 (1973).
 Oehler, D. D., Holman, G. M., *J. Agric. Food. Chem.* 23(3), 590-591 (1975).
 Pickens, L. G., Miller, R. W., *Environ. Entomol.* 4(1), 46-48 (1975).

Richard W. Miller^{*1}
 Calvin Corley²
 Delbert D. Oehler³
 Lawrence G. Pickens¹

¹Chemical and Biophysical Control Laboratory

²Analytical Chemistry Laboratory
 Agricultural Environmental Quality Institute
 Agricultural Research Service
 Beltsville, Maryland 20705

³Veterinary Toxicology and Entomology Research
 Laboratory
 Agricultural Research Service
 College Station, Texas 77840

Received for review December 8, 1975. Accepted February 23, 1976. This paper reflects the results of research only. Mention of a pesticide or a proprietary product does not constitute a recommendation or an endorsement by the U.S. Department of Agriculture.