

A Feeding Study with the Herbicide, Kerb (N-(1,1 dimethylpropynyl)-3,5-dichlorobenzamide, in the Dairy Cow

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The compound, Kerb (N-(1,1 dimethylpropynyl-3,5-dichlorobenzamide) is a broad spectrum herbicide used for selective control of grasses in alfalfa. Residues of the compound may remain on harvested alfalfa (Yih and Swithenbank, 1971a). A feeding experiment was therefore conducted with the compound in a dairy cow to study its pattern of elimination in milk and excreta.

Experimental

A Holstein cow weighing 546 kg and with a daily milk production of 27.96 kg (3.3% butterfat) was catheterized and fed the pure herbicide at the 5 ppm level (based on a daily ration of 22.7 kg) for 4 days. This amounted to a total dose of 0.454 g of the herbicide. The compound in acetone was thoroughly mixed with the evening grain. This concentration represented a somewhat exaggerated dosage as regards typical forage residues at harvest.

Morning and evening samples of the totally mixed milk were taken 1 day prior to feeding (control sample), daily throughout the feeding period and for 6 days thereafter. The morning and evening milk samples were combined each day prior to analysis. The total daily urine and manure samples were collected in specially constructed gutter trays. All samples were immediately frozen prior to analysis.

Extraction, Isolation and Analysis of Residues of Kerb in Milk and Excreta

The analysis of residues of Kerb in milk, urine and feces was performed by an adaptation of the method of Adler, et al. (1972). This method involved conversion of Kerb to methyl 3,5-dichlorobenzoate by digestion of the sample with sulfuric acid and methanol. The latter hydrolysis product was isolated by codistillation and column chromatography on Florisil and final analysis of it was made by electron affinity gas chromatography. The method was sensitive to about 0.01 ppm of Kerb. Table 1 lists the recoveries of Kerb added to control samples.

Results and Discussion

Table 2 lists the daily excretion pattern of residues. Residues equivalent to 0.19% of the total dose of Kerb were

found in milk, The concentration reached a maximum of 0.04 ppm in milk on the day immediately after herbicide feeding ended. Residues of equivalent Kerb in urine and feces, respectively, totalled 44.38% and 4.47% of the total dose. Residues rapidly appeared in the milk and excreta when herbicide feeding began and again rapidly reached non-detectable levels when herbicide feeding ended.

Adler et al. (1972) reported residues no greater than 0.01 ppm of equivalent herbicide in milk when alfalfa containing 7.5 ppm of field-aged residues of Kerb was fed to cows. This result may not be in conflict with our findings since the latter cows consumed a diet in which the residues were probably quite evenly distributed in the ration. In our experiment milk residues may have reached a higher concentration because the compound was fed in four rather concentrated doses (in the evening grain) and as the pure herbicide rather than as a mixture of field-aged metabolites of the compound certain of which may not have even been excreted in milk.

The major portion of the total dose of herbicide was excreted in urine. In a feeding study with a cow Yih and Swithenbank (1971b) reported four metabolites of Kerb. Three of these were identified as β -(3,5-dichlorobenzamido)- β -methylbutyric acid, α -(3,5-dichlorobenzamido)isobutyric acid, and β -(3,5-dichlorobenzamido)- α -hydroxy- β -methylbutyric acid with the latter compound comprising the major metabolites.

A total of 49.04% of the total equivalent herbicide fed was therefore accounted for based on gas chromatographic analysis of milk and excreta. The remainder of the dose was probably excreted as other metabolites not detectable by the method.

Summary

The herbicide, Kerb ((N-(1,1 dimethylpropynyl)-3,5-dichlorobenzamide) was fed to a lactating cow at a concentration of 5 ppm in the ration for four days. Excretion of residues of equivalent herbicide in milk, urine and feces were found to be, respectively, 0.19, 44.38 and 4.46% of the total dose.

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Table 1.

| Recovery of Kerb from Samples | | |
|-------------------------------|---------------|--------------------|
| Sample | Added, ppm | Recovery, percent |
| Milk | 0.02 | 90, 73, 85 |
| | 0.04 | 83, 77, 95, 92, 76 |
| | 0.1 | 74 |
| Urine | 0.2 | 76 |
| | 0.25 | 71 |
| | 0.5 | 75, 68, 86, 82 |
| Feces | 0.01 | 86 |
| | 0.017 | 110 |

Table 2.

Daily Excretion Pattern of Residues in Equivalents of Kerb
Percentage of Total Equivalent Herbicide Dose Excreted in:

| Day | Milk | Urine | Feces |
|----------------|-----------------|-------|-------|
| 1 ^a | -- ^b | -- | -- |
| 2 | -- | -- | -- |
| 3 | 0.04 | 5.32 | 0.12 |
| 4 ^c | 0.01 | 8.64 | 0.72 |
| 5 | 0.08 | 13.96 | 1.06 |
| 6 | 0.05 | 15.66 | 1.38 |
| 7 | 0.01 | -- | 0.94 |
| 8 | -- | 0.70 | 0.22 |
| 9 | -- | 0.10 | 0.03 |
| 10 | -- | -- | -- |
| Total | 0.19 | 44.38 | 4.47 |

^a first day of feeding Kerb

^b residue not detectable

^c last day of feeding Kerb

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