

US EPA ARCHIVE DOCUMENT

LINE BRANCH REVIEW

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FISH & WILDLIFE ENVIRONMENTAL CHEMISTRY EFFICACY

FILE OR REG. NO. 618-75

PETITION OR EXP. PERMIT NO. 5F1646

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PRODUCT MGR. NO. E. Wilson 21

PRODUCT NAME(S) VERTECT 340-F

COMPANY NAME MERCK & Co.

SUBMISSION PURPOSE For use on soybeans

CHEMICAL & FORMULATION 2-(4-triazolyl) benzimidazole

- 1.0 Introduction
- 1.1 Other name is Thiabendazole.
- 1.2 Physical and chemical properties reviewed earlier.
- 1.3 42.28% ai
- 1.4 For use on soybeans
- 1.5 Other reviews for this registration

- 5F 1646 10/6/75
- 5F 1537 11/15/74
- 4E 1478 6/24/74
- 3E 1376 2/19/74
- 618-69,74,75 2/19/74
- 3E 1376 7/31/73

- 1.6 Other reviews for Thiabendazole

- 5G 1649 9/2/75
- 4F 1518 8/6/74
- 3F 1332 2/19/74
- 1F 1031 10/27/70 and two re-evaluations dated
2/12/71 and 10/13/72
- OF 0881 10/9/69

- 2.0 Directions for use:

- 2.1 See review dated 10/6/75.

- 3.0 Discussion of data

- 3.1 Accumulation in mammals.

- 3.1.1 The metabolic fate of Thiabendazole in sheep. Tocco, D. J., Buhs, R. P., Brown, M. D., Matzuk, A. R., Mertel, H. E., Harman, R. E. and Trenner, N. R. J. Med. Chem. 7:399, 1964.

Sheep excrete approximately 75% of the dose in the urine and 14% in the feces in 96 hrs. Only fraction of a part per million was detected in body tissues and other parts of the body which was also eliminated in 16-24 days. The major metabolites were isolated from urine and identified as 5-hydroxythiabendazole which existed either free or conjugated as a glucuronide or sulfate.

- 3.1.2 Absorption, metabolism and elimination of thiabendazole in farm animals and a method for its estimation in biological materials. Tocco, D. J., Egerton, J. R., William Bowers, Christinsen, V. W., Rosenblum, C. J. of Pharmacology and exp. Therapeutics 149, #2, 263 (1965).

Only known metabolites are 5-hydroxythiabendazole and its gluconamide or sulfate ester.

Percent of thiabendazole excreted by cattle, swine and goats in 96 hours after administration of ¹⁴C thiabendazole:

Animal	Dose mg/kg	% of dose excreted		
		Urine	Feces	Total
Cattle	50	65	25	90
Cattle	200	47	34	81
Swine	50	66	10	76
Goats	50	65	24	89
Goats	150	77	20	97

- 3.2 Hydrolysis studies. Report a.

- 3.2.1 Hydrolysis of Radiolabelled thiabendazole in aqueous solution. ¹⁴C ring label study. Analysis by LC and radiochemical techniques.

An hydrolysis study of thiabendazole was conducted for 50 days in a buffered solution in the dark at 1 and 10 ppm. Conclusion: There was no hydrolysis at pH 3.0, 6.0, or 9.0 and at 25°, 35°, and 45°C. Material balance is approximately 100%. Rate of hydrolysis is 0%.

- 3.3 Photochemical degradation. Report b.

- 3.3.1 Photochemical degradation of thiabendazole. (in aqueous solution)

¹⁴C benzene ring labelled thiabendazole used with 300 nm light source.

Photochemical degradation of thiabendazole in deionized water and deionized water containing 2% acetone irradiated with 1.10×10^{17} quanta/sec at 300 nm.

Initial con. 3.68 mg of ¹⁴C TBZ per ml.

deionized water		deionized water containing 2% acetone	
<u>Min</u>	<u>mg/ml TBZ</u>	<u>Min</u>	<u>mg/ml TBZ</u>
0	3.68	0	3.68
10	2.89	5	2.44
20	2.19	7a	0.99
30	1.50	7b	1.76
45	0.70		
60	0.41		

Sixty mins photolyzed product was injected into LC. Total 21 fractions collected. Major fractions are shown below.

<u>Fraction #</u>	<u>% of Total</u>	<u>Identification</u>
1	28.6	Benzimidazole
2	4.1	BI-2-COOM
3	3.1	Unknown
5	1.7	5-OM TBZ
6	14.9	TBZ
8	15.3	BIZ-CONH ₂
11	15.2	Unknown

For all the 21 fractions total of 98.2% of ¹⁴C accounted for. This shows no volatile degradation products.

Photolysis ~~at~~ at pH 3.6 and 9 were run in aqueous buffer. At all pH degradation occurred on thiazole ring. This was determined from 295-305 nm range in the beginning to downward shift to 200-220 nm region.

Conclusion: Photolysis in aqueous solution at pH 3, 6, and 9 and in deionized water is within 60 minutes. Half-life is 23.9 minutes in deionized water and 5 minutes or less in deionized water containing 2% acetone. An acceptable laboratory study was done in deionized water. No photodegradation study was done in or on soil.

3.3.2

Photolysis of thiobendazole. Appendix-PD-II Jacobs, T. A., Carlin, J. A., Walker, R. W., Wolf, F. J., and Vanden Heuvel, W. J. A. J. Agric. Food Chem. 23(4) 704 (1975)

A. Conclusion:

Radio label

Studies of photodegradation on sugar beet leaves showed trace amounts of benzimidazole and benzimidazole-2-carboxamide as metabolites. Studies on glass plates showed minor amounts of these compounds. Photodegradation was slow.

B. Volatility of TBZ and Benzimidazole-2-carboxamide.

¹⁴C labelled TBZ was studied on glass slides.

Conclusion: TBZ is stable on glass slides. This is not a required study.

- 3.3.3 Electron donor and affinity constants and their application to the inhibition of acetylcholinesterase by carbamates. Begumil Hetnarski and Richard D. O'Brien. J. Agric. Food Chem., 23(4) 709 (1975).

This is not an environmental chemistry requirement.

- 3.3.4 7-4B. Chemical Actinometers for the determination of ultraviolet light intensities. J. G. Calvert and J. N. Pitts, Photochemistry 1966, J. Wiley and Sons, Inc. (pp 780-788).
Appendix PD-III
This reference describes chemical actinometers and calculations. This study is not germane.

- 3.3.5 Appendix PD-IV

No new data: This is a sheet of papers which shows ¹⁴C print out and data are already reported in 3.3.1.

- 3.4 Leaching studies: Report c.

- 3.4.1 Soil leaching studies: column method ¹⁴C radiolabelled Thiabendazole at 15 ppm.

Physical Characteristics of Soils

<u>Soil Type</u>	<u>pH</u>	<u>% Organic Matter Content</u>	<u>% Sand Content</u>	<u>% Silt Content</u>	<u>% Clay Content</u>
Elburn(A)	6.4	3.33	54	30	16
Plainfield Sand(B)	6.2	0.82	94	4	2
Plano Silt(C)	5.4	3.65	20	65	15
Kewaunee Clay(D)	6.2	0.54	24	18	58
Kidder(E)	6.8	1.31	62	11	27

Total ¹⁴C Found in Column Inches

<u>Soil Type</u>	<u>Top 1"</u>	<u>Top 2nd inch</u>	<u>Remainder in 3-12"</u>	<u>¹⁴C Found in leachate</u>
A (Sandy Loam)	83-97%	N.F.	N.F.	N.F.
B (Sand)	65-95%	4-12%	N.F.	N.F.
C (Silt Loam)	86-97%	~1%	N.F.	N.F.
D (Clay)	79-88%	0-6%	2-3%	N.F.
E (Sandy Clay Loam)	77-93%	N.F.	N.F.	N.F.

N.F. - None Found

Study was carried out with two different tubing type 7.03-7.33 cm₂ and 3.06 cm₂ diameter area.

Similar studies were also carried out with ¹⁴C-ring labelled DDT and 2,4-D.

Leaching data for DDT were similar to TBZ, while 2,4-D was found to move rapidly through the length of the column and 75% of the applied ¹⁴C was found in leachate.

An aged leaching study to measure leaching of metabolites was not done.

Conclusion: ¹⁴C equivalent to TBZ does not leach. There is no evidence to show that ¹⁴C is still present as TBZ.

- 3.4.2 Appendix SL-I Protocol reviewed earlier.
Appendix SL-II Scintillation counter print sheets. Data already reported in 3.4.1 and reviewed.
Appendix SL-III Computer printout data already reported in 3.4.1 and reviewed.

- 3.5 Soil Metabolism. Report d.
(Aerobic and Anaerobic soil studies).

- 3.5.1 Metabolic fate of radiolabelled Thiabendazole in soil.

Soil Analysis: For Soil Bound Residue Studies

Soil	Mineral Fractions			Organic Matter	pH
	Sand	Silt	Clay		
SM(Sandy Loam)	58	37	5	.51	5.6
LSU 6(Silt Loam)	9.5	74.5	16.0	.10	4.8
LSU 3(Silt)	12.5	81.5	6.0	.47	5.0
WES(Sandy Loam)	77	14	9	.56	5.1
SDL(Sandy Loam)	53.6	29.2	17.2	1.65	6.7
ARK(Silt Loam)	3.2	78.0	18.8	.92	5.2

The carbon 14 label is on the benzene ring. All aerobic and anaerobic experiments are carried out in the dark at ~22°C. Aerobic aging involved both open and closed systems. Anaerobic study was carried out after aging soil for 60 days aerobically in the dark. Anaerobicity was obtained by flooding and maintained by stoppering flasks flooded with nitrogen. The solvent extraction system for aerobic and anaerobic systems is isopropyl alcohol, formic acid, and water.

A. Aerobic soil studies.

Conc. of ^{14}C expressed as ^{14}C -Thiabendazole in soil samples after aerobic aging under soil conditions and bound ^{14}C after soxhlet extraction in ppm.

Time (days)	Total ppm found	Total after soxhlet extraction bound residue ppm	Total ^{14}C in soxhlet extract ppm
1	10.41	1.41	8.30
2	9.75	1.62	7.45
4	9.08	1.98	7.25
7	9.04	2.94	5.48
10	8.69	1.90	6.52
32	8.97	2.07	6.48
58	8.66	1.92	6.33
76	9.55	3.30	5.05
106	9.21	2.79	5.54
125	9.58	N.R.	5.94
133	9.32	2.81	6.24
160	6.97	2.73	5.51

The curve of the above data levels off after 160 days. Total found as $^{14}\text{CO}_2$ is 0.68-3.38% of total.

All soxhlet extracted ^{14}C was TBZ. No metabolites.

All bound residue was found in Humin, fulvic acid and Humic acid fractions.

Conclusion: (1) Aerobic degradation of TBZ is slow. Half-life of extractable TBZ is about 408-423 days. (2) Incubation has not been carried out to a 90% loss.

B. Anaerobic soil studies.

Concentration of ^{14}C found in soxhlet extraction, in soil bound and total when carried out anaerobically.

<u>Time (days)</u>	<u>ppm found in soxhlet extraction</u>	<u>ppm found soil bound</u>	<u>ppm found in water to make anaerobic conditions</u>	<u>Total ppm found after anaerobic study</u>
1	4.94	4.20	0.16	9.43
4	4.63	4.51	0.14	9.81
7	4.99	4.24	0.14	9.72
14	4.72	4.61	0.30	9.62
21	3.69	5.92	0.18	9.85
56	5.47	4.34	0.18	9.78
94	3.10	5.48	0.53	9.21
122	3.82	5.28	0.35	9.41

The curve of the above data levels off after 122 days. All extracted ^{14}C is TBZ.

Conclusion: Anaerobic dissipation is faster than aerobic dissipation. Half-life of extractable TBZ is about 274-278 days.

3.5.2 SM-I to SM-IX and XI are detailed data, soil description of soils, etc. already covered in 3.5.1.

3.5.3 Method for the analysis of Thiabendazole in soil. SM X.

Described an extraction procedure for TBZ from soil.

Conclusion: Methodology is satisfactory. It involves soxhlet extraction with an azeotropic mixture of isopropyl alcohol, formic acid, and water. After solvent partition with ethyl acetate, analysis is done by HPLC and UV detection.

3.5.4 SM XII Adsorption, Mobility and Persistence of Thiabendazole and Methyl-2-benzimidazole carbamate (MBC) in soils. Nadav Aharonson and Uzi Kafkafi, J. of Agric. Food Chem., Vol. 23 #4, 720 (1975).

Soil Analysis

Soil type	Soil Fraction, % of total					CaCO ₃ , %	Cation exchange capacity	Organic matter	pH
	Coarse sand	Sand	Silt	Clay					
Hamra (Loamy sand)	7.5	75.2	3.6	13.1	2.2	13.8	0.8	7.8	
Loess (Sandy loam)	2.2	53.3	34.7	9.7	15.4	15.7	0.9	7.9	
Hydromorphic grumusol (Clay loam)	8.9	38.3	21.3	31.4	4.3	33.4	1.2	7.9	

a. Adsorption Studies:

TBZ: Thio bendazole: MBC 2-Benzimidazolecarbamic acid methyl ester.

Concentration of TBZ and MBC in the Water at Equilibrium in Various Water-Soil Ratios

Fungicide	Quantity of fungicide ^a adsorbed to the soil, ppm	Soil	Ratio water: soil	Concn in the water at equilibrium, ppm
TBZ	8	Loess	1:2	0.44
	8	Loess	1:1	0.45
	8	Loess	2:1	0.52
	8	Loess	4:1	0.52
	8	Loess	8:1	0.41
TBZ	5	Hydromorphic grumusol	1:2	0.15
	5	Hydromorphic grumusol	1:1	0.12
	5	Hydromorphic grumusol	2:1	0.18
MBC	4	Loess	2:1	0.8
	4	Loess	3:1	0.7
	4	Loess	4:1	0.6

^aFungicide applied to 50 g of soil in ethyl acetate and air dried and shaken with water for 8 hrs.

Concentration of TBZ and MBC in the Soil-water at Equilibrium and the Relation to Their Initial Concentrations in the Soil

Quantity of fungicide adsorbed to soil, ^a ppm	Concn of TBZ in the soil-water at equilibrium, ppm		Concn of MBC in the soil-water at equilibrium, ppm	
	Loess	Hydromorphic grumusol	Loess	Hydromorphic grumusol
30	2.3			
24	1.8		9.5	
16	1.2	0.3	5.8	5.5
8	0.5	0.15	2.4	2.2
4	0.25	0.07	1.2	1.0
2	0.1		0.5	
1	0.05		0.25	

^aThe fungicides were adsorbed to 25 g of soil in ethyl acetate; the soil was air dried and shaken for 8 hr with 25 ml of water.

The following data is estimated from a graph of adsorption isotherms for TBZ.

hydromorphic grumusol	Amount adsorbed (ug/25g soil)	Equilibrium concentration (ug/ml)
	260	0.6
	500	1.3
	700	2.4
hamra	200	0.9
	400	2.0
	500	3.5
loess	190	1.1
	375	2.2
	500	3.5

It was also found that adsorption is more at lower pH and TBZ adsorbed more than MBC.

b. Leaching study:

Leaching studies was carried out in 22 cm long column and this was top with 50 g soil containing 4500 mg of TBZ and 2200 ug of MBC which is 90 and 22 ppm respectively. This was eluted with 1700 ml of water (equivalent to 1000 ml or 40" of rain).

At this such a high concentration no TBZ found in leachate but 71% of MBC found in leachate. Most of TBZ was found in top 18 cm of soil in 35 cm long column. This column was 22 cm long and additional top 13 cm was due to 50 g soil treated with fungicides so actual leaching is in top 15 cm of the soil.

c. Persistence in soil:

Effect of Moisture and Time on the Disappearance of Adsorbed TBZ from
Three Soils^a

Soil type	Moisture content	TBZ residues, ppm			
		0 ^d day	After 3 months	After 6 months	After 9 months
Hamra	Dry ^b	6.9	6.7	6.7	6.5
	Field capacity (aerobic)	5.6	4.6	4.0	3.9
	Anaerobic ^c	5.6	4.9	3.9	3.5
Loess	Dry	6.8	7.0	6.2	6.1
	Field capacity (aerobic)	5.4	5.0	4.7	4.6
	Anaerobic	5.4	5.0	4.7	3.5
Hydromorphic gumusol	Dry	5.1	4.8	5.1	5.3
	Field capacity (aerobic)	4.7	4.1	3.8	4.2
	Anaerobic	4.7	3.7	3.7	4.2

^aRecrystallized TBZ was adsorbed to the soil. ^bAir-dried soil. ^cOne centimeter of water above the soil. ^dDifferences in the initial concentration due to different soil batches.

Persistence of MBC was also studied and TBZ was found to be much more persistent compared to MCB.

Conclusion:

- (1) Comparatively TBZ adsorbed much more compared to MBC.
- (2) Adsorption is higher at lower pH.
- (3) TBZ leaches negligibly and none found in leachate.
- (4) TBZ in aerobic and flooded (anaerobic) soils losses of 10-25% are observed for over a period of 9 months compared to 70-80% for MBC for the same period.

3.6 Field studies. Report e.

3.6.1 Field dissipation studies: (In soybeans grown field).

Soil Analysis

Soil	Mineral Fraction			Organic Carbon	pH
	Sand	Silt	Clay		
Alabama SM (1) (sandy loam)	58	37	5	.51	5.6
Alabama WES (2) (sandy loam)	77	14	9	.56	5.1
Arkansas (3) (silt loam)	3.2	78.0	18.8	.92	5.2
Louisiana 0-5" (4) (silt)	12.5	81.5	6.0	.47	5.0
Louisiana 7-9" (5) (silt loam)	9.5	74.5	16.0	.10	4.8
Wisconsin (6) (sandy loam)	53.6	29.2	17.2	1.65	6.7

HPLC was used to analyze nonradioactive samples from 4 geographic locations for TBZ.

Two applications of mertect at two weeks interval were made on soybeans fields from 3.3 oz. ai/A, 5.0 oz. ai/A and 16 oz. ai/A.

Most of the 237 studies of 0-3" and 3-6" showed less than 0.1 ppm TBZ. Twenty-two samples showed concentrations between 0.1 and 0.2 ppm. Seven samples showed concentrations greater than 0.2 ppm. Samples were analyzed on 8/7/75 (date of first application), 8/22/75 (date of second application), 9/18/75, 10/21/75, 11/26/75, and 4/7/76. Too little data is recorded on 6-12" and 12-18" to be conclusive.

Need samples at a later date and down to depth of 6-12" & 12-18"

All the soils were treated at 1 lb ai/A and aged 30 days. For the ^{14}C studies, analysis were carried out on all soils for total ^{14}C , extractable ^{14}C and ^{14}C left in soil after extractions.

Total ^{14}C after 30 day aging was 78-100%, total ^{14}C extracted from above soil 61-92% with one exception of Louisiana soil found to contain only 27-32% extractable ^{14}C and ^{14}C bound was 60-71%. Total ^{14}C bound varied from 16-35%.

For soils enriched at the 0.1 ppm level, the solvent used to extract ^{14}C was an azeotropic mixture of isopropyl alcohol, formic acid, and water.

Conclusion: Dissipation takes place in soil four to six weeks after application, Mertect is not found in soil as a parent compound. (This is when application is carried out on foliage.)

Actual incorporation in soil dissipation is very slow.

- 3.7 Rotational Crop Residue studies. Report f.
- 3.7.1 Secondary crop uptake with ^{14}C TBZ in aged soil.

Soil Analysis

Wisconsin soil

	<u>Sand</u>	<u>Silt</u>	<u>Clay</u>	<u>OM</u>	<u>pH</u>
Sandy Loam	53.6%	29.2%	17.2%	1.65	6.4-6.7

Soybeans were grown in soil which was treated twice with 4 oz. ai/A of ^{14}C -benzene ring labelled TBZ. 120 days after second application top 6" of soil was taken and radish, bush beans and rye grass were grown.

<u>Rotational Crop</u>	<u>^{14}C in soil just before planting rotational crop</u>	<u>ppm found at maturity</u>
Radish	0.156	ND
Bush Beans	0.153	ND
Rye Grass	0.163	0.036

Conclusion: No or negligible ^{14}C residue was found in rotational crops. *can rotate 11/10/77*

- 3.8 Microbes studies. Report g.
- 3.8.1 Effect of Thiabendazole on soil microorganism.

Soil Sandy Loam.

TBZ in the soil at 10 & 20 ppm has no adverse effect upon the fungi, the actinomycete or the algae employed in the tests.

TBZ in soil at 10 & 20 ppm has an effect upon the bacteria within 48 hrs. At 7 days there is a 99.9+ percent reduction of these micro-organisms.

TBZ in the soil at 0.1 ppm had no effect and at 1.0 ppm may have had a slight effect upon certain bacteria.

Effect of TBZ was determined by population counts.

Conclusion: TBZ has no effect on fungi, actinomycete, or algae. TBZ had no effect on bacteria at 0.1 ppm, but will kill bacteria at 10 & 20 ppm. Thiabendazole has a slight effect on bacteria at 1.0 ppm.

3.9 Fish studies. Report h.

3.9.1 Accumulation and dissipation of Thiabendazole in catfish.

Fish pool contained 1/2 inch of sandy loam soil enriched with ¹⁴C benzene ring TBZ aged aerobically for 30 days.

Conc. of ¹⁴C-TBZ equivalent in edible and nonedible portions of the fish and ¹⁴C in water and sediment when treated with 1 ppm 30 day aerobically aged soil contained in water

Time (days)	Edible portion ppm range	Nonedible portion ppm range	¹⁴ C in water ug/l	¹⁴ C in whole sediment ug/l
0	0.00 -0.00	0.00 -0.00	---	---
1	0.014-0.024	0.074-0.101	---	---
7	0.016-0.047	0.071-0.138	---	---
10	0.020-0.039	0.087-0.214	---	---
14	0.034-0.041	0.088-0.136	1.2	0.964
17	0.021-0.040	0.116-0.137	---	---
21	0.024-0.037	0.066-0.115	---	---
24	0.020-0.040	0.107-0.161	2.0	1.16
28	0.024-0.042	0.123-0.149	2.0	1.26
31	0.020-0.032	0.140-0.173	---	---
35	0.009-0.051	0.114-0.185	1.7	0.667
38	0.024-0.038	0.038-0.175	---	---
42	0.015-0.026	0.103-0.158	1.0	1.09
45	0.014-0.023	0.115-0.139	---	---
49	0.015-0.023	0.079-0.125	1.4	.994

Conc. of ^{14}C in edible and nonedible portions of fish in withdrawal period

<u>Withdrawal days</u>	<u>Range of ^{14}C in edible portion ppm</u>	<u>^{14}C residue in nonedible portion ppm range</u>
1	0.009-0.011	0.020-0.028
3	0.009-0.015	0.017-0.023
7	0.009-0.012	0.016-0.020
9	0.008-0.013	0.015-0.019
13	0.007-0.012	0.016-0.019
16	0.007-0.009	0.013-0.021
20	0.005-0.011	0.002-0.014

The soil weighed 125 kg. Water volume was 88.18 ft³ + (2,500 l). The fish were Channel Catfish 3-1/2" to 4" long and weighed an average of 5 grams.

Soil was agitated in water. Foam and scum were removed. The soil was pulverized and put through an 8 mesh sieve. A small amount was put through a 20 mesh sieve and ^{14}C Labeled TBZ was mixed with this soil as a water solution. The two soils were mixed before aging.

Residues in fish, soil, and water are ^{14}C equivalent of TBZ. Analysis of ^{14}C in fish, soil, and water was by sample combustion and liquid scintillation counting.

Partition by polar and nonpolar solvents was not done.

Conclusion: There appears to be no accumulation in catfish. The study is acceptable.

4.0

Summary of Data

Sheep excrete 89% of TBZ in 96 hours. Metabolites in farm animals are 5-hydroxythiabendazole and its gluconamide or sulfate ester. TBZ does not hydrolyze. Photolysis of TBZ occurs with a half-life of 23.9 minutes in deionized water and a half-life of less than five minutes in deionized water and acetone. Photodegradation of TBZ to benzimidazole and benzimidazole-2-carboxamide on glass plates and sugar beet leaves is slow. TBZ is not volatile on glass slides. ^{14}C equivalent to TBZ does not leach. Aerobic degradation of TBZ in soil is slow, with a half-life of 408-423 days. Anaerobic dissipation in soil has a

half-life of 274-278 days. The method of analyzing TBZ in soil using soxhlet extraction, HPLC, and UV detection is adequate. TBZ is adsorbed by soil more than 2-benzimidazolecarbamic acid methyl ester. TBZ is adsorbed more by soil at lower pH. TBZ dissipates in soil so that it is not found as a parent compound after 4 to 6 weeks. No or negligible TBZ was found in rotational crops. TBZ had no effect on fungi, actinomycete, or algae. TBZ had no effect on bacteria at low concentrations (0.1 ppm) and a slight effect at 1.0 ppm. Higher concentrations of TBZ killed bacteria. There is no accumulation of TBZ in catfish. →

5.0

Can rotate - R. Ney 11/7/77
Recommendations

We do not concur with the proposed use because the following, which are required under Sec. 3, have not been submitted as referenced:

- 1) Aged leaching study.
- 2) Field soil study.
- 3) Photodecomposition in soil.
- 4) Effects of microbes on pesticides, sterile vs. nonsterile.

R. E. Ney 9/29/76
Nancy Dodd 9/29/76

Ronald E. Ney, Jr. 9/22/76
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