

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: April 25, 1977

SUBJECT: Response to Camp memo of March 30, 1977

FROM: Environmental Chemistry Section
Efficacy & Ecological Effects Branch

TO: Acting Director
Registration Division

THRU: Pesticide Science Officer
Registration Division



In response to your memo:

1. Incremental risk assessment for terrestrial crop use of thiabendazole (TBZ).
 - a. TBZ has registered status for application to the growing crop sugar beets. The approximate sugar beet acreage grown annually is about 1,000,000 acres of which it is estimated 25,000 could be treated with TBZ. Most of this acreage is in California, East of the Rockies and the Northern Plains.
 - b. The proposed new use of TBZ is on the growing crop soybeans. The approximate soybean acreage is about 50,000,000 acres of which it is estimated 6,000,000 acres may be treated with TBZ. Most of these acreages are in the lower Mississippi Valley.
 - c. All other accepted uses were of a character that did not require environmental chemistry assessment. These uses were not considered in the incremental increase. This incremental increase is from an estimated 25,000 acres to an estimated additional 6,000,000 acres, a 240 fold increase in acreage. This represents an additional undefined burden on the environment.
2. The following scientific facts are noted on TBZ.
 - a. Laboratory experiments with ¹⁴C-ring labeled TBZ found it to be stable in soil under aerobic and anaerobic conditions without LIGHT. The only extractable compound was TBZ and the rest of the ¹⁴C compound(s) were unextractable. The T-1/2 was over a year in soil.
 - b. Photolysis in deionized water solution yielded 21-photo products in 60 min. The major products were TBZ 14.9%, benzimidazole 28.6%, benzimidazole-2-carboxamide 15.3% and unknowns 15.0%. Photodegradation occurred at pH 3, 6 and 9 but no identity work was done.

- c. Photolysis on sugar beet leaves was slow. Only small amounts of benzimidazole and benzimidazole-2-carboxamide were found when plants were grown in a Phytotron. Plants grown outside showed additional degradation. Plants grown in a Phytotron contained 95% of total applied ^{14}C -TBZ, 97 to 98% of this was TBZ. Plants exposed to sunlight contained 76% of total applied ^{14}C -TBZ, 78% of this total was TBZ and 22% altered unidentified products and there was a 24% loss of total ^{14}C TBZ. The crop surface may have an inhibiting effect on photodegradation of TBZ. This is not indicated in the photodegradation study in water. If TBZ photodegrades on soil, the products formed may be benzimidazole and benzimidazole-2-carboxamide of which the latter is a suspected teratogen. These may be taken up by rotational crops or accumulated in fish. The rotational crop and fish accumulation studies were done in a way that photodegradation may not have occurred and thus not be present. Photodegradation appears to be the primary mode of degradation in the environment.
- d. TBZ is stable at pH's of 3, 6 and 9 at 25 to 45°C, yet acid is used as partition method in clean up procedure. If an acid can partition TBZ, then it should not be stable at the acidic pH's tested.
- e. Field experiments using ^{14}C -TBZ showed residues binding in soil. The only extractable residue is TBZ. Parent compound is not found in soil when foliar applied. This may be indicative of photodegradation prior to contact with soil or photodegradation on the soil surface. This shows that photolysis data on the soil surface is needed for further assessment.
- f. Rotational crops did not pick up ^{14}C -TBZ from treated soil. This experiment, as set up, may prevent photodegradation, thus uptake of photoproducts would not be considered. Photodegradation appears to be a major route of degradation and is needed to assess if additional crop uptake studies are needed.
- g. Fish were exposed to soil treated with ^{14}C -TBZ and aged 30 days prior to exposure. This experiment, as set up, would prevent photodegradation, thus accumulation of photo products would not be considered. Photodegradation appears to be a major route of degradation and is needed to assess potential for accumulation in fish.
- h. The results of hydrolysis studies show TBZ to be stable at pH's 5, 7 and 9. Residue methods for crops extract TBZ with ethyl acetate and then clean this extract with NaOH and then partition with HCl.

The TBZ is partitioned into the HCl layer, indicating a reaction must have occurred in the hydrolysis study at pH 5, but none was reported. An explanation is needed. TBZ in the HCl solution is reacted with NaOH then the method proceeded onward. These results indicate that if TBZ is converted in acid soil, the reaction product would not be extracted with the solvent (ethyl acetate). If the solvent contained NaOH, then perhaps extractable identifiable residues may be determined. The same would apply to crops and animals (fish) if such reaction occurred in living bodies. A reaction with acid is probable in animals, ~~but~~ may or may not be the case in plants. In any case, extracting with solvents containing NaOH should be tried, to determine what and/or if any additional residues are extractable from soil, water and living organisms. We do not know if work has been done to identify such products, but if a reaction occurs, the methods submitted will not extract said product(s). Recovery data will not determine reacted products or losses formed in time (aged) studies. The above (h) is speculative but is indicative of problems with TBZ.

3. The data gaps, once fulfilled will enable us to assess uptake in rotational crops and in fish. If photodegradation occurs one of the products may be benzimidazole-2-carboxamide a possible teratogen which could be taken up (and we will defer to Toxicology Branch for additional hazard assessment). Photodegradation in water is the only mode of degradation thus far identified and dissipation is via binding in soil.
4. The incremental risk assessment for ^{the} additional terrestrial use *on any plane* is that the risk is unacceptable as indicated in 1, 2 and 3 above. Further review to determine incremental risk will be made after data requested is submitted and reviewed and data in OPP files is validated.

Ronald E. Ney, Jr.
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cc:

Martin H. Rogoff, Ph.D