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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: PP #6F3343/6H5486. (RCB #519, 509) Thiophanate-methyl in/on Rice and Grapes, Milk, the Kidney and Liver of Cattle, Goats, Hogs, Horses, and Sheep, and Poultry Liver. Evaluation of the Analytical Method and Residue Data. Accession No. 260822

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and

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The Agchem Division of Pennwalt Corporation proposes the establishment of permanent tolerances for residues of the fungicide thiophanate-methyl (dimethyl [(1,2-phenylene)-bis(iminocarbonothioyl)] bis[carbamate]), its oxygen analogue, dimethyl-4,4'-*o*-phenylene bis(allophanate), and its benzimidazole-containing metabolites (calculated as thiophanate-methyl) in/on the following raw agricultural commodities and processed commodities:

Raw agricultural Commodities	Proposed tolerance (ppm)
Grapes	10
Rice	5
Rice straw	15

Processed Commodities	Proposed Tolerance (ppm)
Grape pomace, dried	125
Raisins	50
Raisin waste	125
Rice hulls	20

Permanent tolerances for thiophanate-methyl/metabolites have been established on animal commodities under 40 CFR 180.371. Pennwalt proposes to amend the tolerances as follows:

Commodity	Established Tolerance (ppm)	Proposed Tolerance (ppm)
Milk	1.0	2.0
Liver of swine and horse	1.0	5.0
Liver of cattle, goats, and sheep	2.5	*5.0
Kidney of cattle, goats, and sheep	0.2	0.5
Eggs; meat, fat, and meat by-products (except liver and kidney) of cattle, goats, and sheep	0.1	
Meat, fat, and meat by-products (except liver) of swine, horse, and poultry	0.1	
Kidney of horse and swine	0.1	0.5
Poultry liver	0.2	0.4

*RCB assumes that the proposed tolerance of 0.5 ppm for goat liver in Section F is a typographical error and that the intended tolerance is 5.0 ppm as stated elsewhere in the text. The petitioner will need to verify that 5.0 ppm is the intended tolerance in a revised Section F.

Both benomyl and thiophanate-methyl yield the same metabolite, methyl-2-benzimidazole carbamate (MBC); therefore 40 CFR 180 (d) (10) is relevant, namely, "Where a tolerance is established for more than one pesticide having as metabolites compounds containing the benzimidazole moiety found in or on a raw agricultural commodity, the total amount of such residues shall not exceed the highest established tolerance for a pesticide having these metabolites."

Since benomyl and thiophanate-methyl control the same pests (N. Pelletier, BUD), there is little likelihood that illegal residues would result from the treatment of the same crop with both fungicides.

A temporary tolerance (as a result of PP #2G2662) was established for the combined residues of thiophanate-methyl/metabolites on rice (5 ppm), rice straw (15 ppm), and rice hulls (20 ppm, feed additive tolerance). Proposed temporary and permanent tolerances for the combined residues of thiophanate-methyl/metabolites on rice and grapes were withdrawn without prejudice (PP #2G2639, PP #2F2729).

Permanent tolerances for the combined residues of thiophanate-methyl/metabolites ranging up to 15 ppm on stone fruits and up to 50 ppm on the feed item bean forage and hay have been established.

Many of the defieciencies pointed out in this review of PP #6F3343/6H5486 have been discussed in the Residue Chemistry Chapter (2/15/86) of the Thiophanate-methyl Registration Standard.

Conclusions

1. RCB assumes that the proposed tolerance of 0.5 ppm for goat liver in Section F is a typographical error and that the intended tolerance is 5.0 ppm as stated elsewhere in the text. However, the petitioner should verify that 5.0 ppm is the intended tolerance in a revised Section F.

2a. According to Dr. Robert Pool (telecon, 2/21/86), Department of Pomology, Cornell University, bud break in NY occurs around May 1st, and harvest takes place from September 1 to October, 25. Since a 7 day PHI is imposed, and applications are permitted from the first appearance of foliage, about 12 applications are theoretically possible. The petitioner will need to specify the total number of applications permitted to grapes East of the Rockies in a revised Section B/label. The proposed use should, of course, be supported by appropriate residue data.

2b. Aerial application and ground equipment application are permitted for the use of Topsin-M on grapes and rice. The petitioner should specify the gallonage per acre for aerial applications to grapes and rice.

3a. Investigations of the metabolism of TM by apples, beans, and grapes have established that the terminal residues of toxicological concern are the parent, the oxygen analogue of TM, allophanate, methyl 2-benzimidazole carbamate (MBC), and metabolites containing the benzimidazole moiety. RCB concludes that the nature of the residue in rice and grapes is adequately understood.

3b. Although RCB considers the nature of the residue in milk to be adequately understood, 4-OH thiophanate-methyl, which can constitute up to 13% of the terminal residues in milk (up to 0.3 ppm from the proposed use on rice and grapes), is not included in the current tolerance expression. The present submission proposes tolerances of 125 ppm on the feed items grape pomace and raisin waste. Therefore, at this time RCB defers to TOX on the need to regulate 4-OH thiophanate-methyl.

3c. 5-OH MBC/conjugates and 5-OH-2-aminobenzimidazole (5-OH-2-AB) accounted for about half of the activity in the bound liver residues and were identified only after passage through 2 animals (first a cow and then a rat); so it is difficult to determine which animal metabolized the thiophanate-methyl to the terminal residues excreted by the rat. However, the rat study does show that bioavailable residues of toxicological concern are present in bound beef liver residues. Since attempts to identify the freely extractable residues (which account for about 1/3 of the activity of the liver) had met with little success, only about 35% of the terminal radioactive residues in liver have been identified; RCB concludes that the nature of the residue in beef liver is not adequately understood.

3d. The radioactive residues present in cattle fat, muscle, and kidney were not adequately characterized. A radioactive study carried out by IBT (of which RCB has no record of validation) indicates that analysis of conjugates may also be a problem with beef kidney. Although all the radioactivity was extractable, a kidney which contained 11.2 ppm TM equivalents by radioassay was found to contain only 0.05 ppm TM and 0.12 ppm MBC by chemical assay. Because of the shortcomings of the available metabolism studies, the Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard has cited the inadequacies of the delineation of the terminal residues in meat as a data gap.

RCB concludes that the nature of the residue in meat is not adequately understood for the proposed use, which could lead to residues of TM/metabolites of up to 125 ppm on livestock feed items (e.g., grape pomace and raisin waste).

3e. Residues in poultry fat and liver were not identified. Liver tissue was not examined although ruminant metabolism studies had indicated that bound residues in liver could be a problem. Moreover an IBT study (of which RCB has no record of validation) indicated that radioactive residues concentrate in poultry liver. The Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard requests additional data depicting the nature of the residue in poultry tissues. RCB concludes that the nature of the residue in poultry tissue is not adequately understood for the purpose of the proposed use on grapes and rice; feed commodities associated with grapes and rice may be fed to poultry.

3f. RCB concludes that the nature of the residue in eggs is adequately understood. The residues of toxicological concern are the parent, its oxygen analogue allophanate, and residues containing the benzimidazole moiety.

4a. RCB concludes that the methodology used to generate residue data on grapes and rice was adequate for data collection. However, the Residue Chemistry Chapter (2/15/86) of the Thiophanate-methyl Registration Standard questions the adequacy of the spectrophotometric methodology for enforcement purposes (see Analytical Methodology section of this review). For the establishment of tolerances on rice and grapes, RCB concludes that the petitioner should submit his HPLC method that determines TM, MBC, and allophanate as a replacement for the current UV enforcement method for the determination of residues in plants (see p. 16--Analytical Methodology section of this review).

4b. RCB concludes that methodology capable of determining bound residues in beef liver is not available. Bound residues in liver were freed only following digestion by a rat. RCB also notes that there is no confirmation that the available methodology is capable of determining residues of toxic concern in beef kidney.

4c. Furthermore, the nature of the residue in meat and poultry tissue is not adequately understood. Should other metabolites of toxicological concern be identified, appropriate methodology may have to be developed.

4d. RCB has deferred to TOX on the need for regulating residues of 4-OH TM, which may constitute up to 13% of the terminal residues in milk. Should TOX concluded that this metabolite is of concern, appropriate analytical methodology may need to be developed.

4e. RCB reserves judgment on the adequacy of the procedure used to determine residues of TM/metabolites in milk. The Residue Chemistry Chapter (2/15/86) of the Thiophanate-Methyl Registration Standard questions the ability of the current methodology to free conjugates of regulated residues. The hydrolysis of conjugates by acid, as specified in the protocol, has not been confirmed. The Registration Standard notes that in the metabolism studies, hydrolysis of conjugates was effected mainly by enzymes.

4f. RCB tentatively concludes that adequate methodology is available for the analysis of TM/metabolites in eggs.

5a. The petitioner will need to specify the storage conditions and storage periods used for the samples from his rice field trials. Some studies were conducted 13 years ago. The storage information should cover the period from harvest to analysis.

5b. RCB cannot accept a label restriction against use of Topsin in CA because California produces approximately 24% of the nation's rice, a major crop. Almost 4 years ago, the petitioner was informed that he would need to submit residue data generated on rice grown in CA (see RCB's 8/16/82 review of PP #2G2662). Therefore residue data from CA are still required. The locations of the field experiments should reflect all of the principal growing regions of the crop as indicated in the annual USDA publication Agricultural Statistics, even if no pest pressure currently exists in some of the major growing areas. The petitioner should conduct his CA field trials so that they reflect his intended 21 day PHI. None of the submitted rice straw field trials reflect a 21 day PHI.

5c. Raw data sheets from the field trial cooperators have not been submitted. The petitioner should supply these data sheets so that RCB can validate the treatment rates, PHI's of the field trials, storage conditions of the field samples, etc. These sheets can also furnish pertinent climatological data which may help to explain any aberrant residue levels.

5d. At this time RCB reserves judgment on the appropriateness of the proposed tolerance for residues of TM/metabolites on rice and straw arising from the proposed use until the receipt of information on storage conditions of the field samples and residue data from CA. The residue data should include some analyses of rice and rice straw samples for allophanate.

5e. Although no residue levels of allophanate were submitted, data submitted with PP #9F2274 indicate that this residue usually accounts for less than 10% of the terminal residues. The crops investigated were: cucumbers, tomatoes, grapes, peach, citrus, and wheat, which is a member of the same crop grouping as rice. However, RCB reserves its conclusion on whether more allophanate residue data on rice are needed until the CA data have been submitted.

5f. The only commodity in which residues of concern concentrate is rice hulls. The value of the concentration factor depends upon the residue level in the sample from Bay City, TX. This sample is variously described as exhibiting total TM levels of 0.3 ppm and 0.03 ppm. The petitioner will need to address this discrepancy.

5g. At this time RCB can make no judgment on the adequacy of the proposed tolerance for residues of TM/metabolites on rice hulls until problems associated with the rice residue data have been resolved (CA residue data; storage conditions).

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5h. The dosage rate in this grape field trial appears as "1.08-5 lbs. a.i./A" in the summary table (page D-13 in PP #2G2639, amendment of 1/24/83). RCB questions this dosage rate because only one residue level value was given and because the 5 lb rate is markedly higher than the other treatment rates. The petitioner should verify the dosage rate in this trial (Biglerville, PA, Sample No. 67-T).

5i. No raw data sheets from the grape field trial cooperators were submitted so that RCB can check the dosage rate used in the Biglerville, PA, trial. Raw data sheets from the field cooperators should always be submitted so that RCB can validate the treatment rates, PHI's of the field trials, storage conditions of the field samples, etc. These sheets can also furnish pertinent climatological data which may help to explain any aberrant residue levels.

5j. The residue data for residues of total TM on rice reflected corrections for recovery; the residue data submitted in January, 1983, for grapes as part of PP #2G2639 were not corrected for recoveries, and the petitioner did not specify whether the grape residue data submitted with PP #2F2729 and with the initial submission of PP #2G2639 were corrected for recoveries. The petitioner will need to specify whether the latter data were corrected for recoveries.

5k. Residue levels of allophanate were determined in only 2 field trials (one of which reflected a 146 day PHI). In these trials, allophanate was found to constitute up to 3% of the residues determined. Allophanate residue data on grapes submitted with PP #9F2274 corroborate this result; allophanate residues constituted 2-6% of the residues determined 1-30 days after application. Therefore RCB concludes that additional allophanate residue data on grapes are not needed.

5l. If the petitioner intends to permit more than 7 applications (12 applications are theoretically possible; see Conclusion 2a) he will need to submit additional residue data reflecting his intent. The petitioner also has the option of limiting the total number of applications permitted to grapes to 7 applications in a revised Section B/label.

5m. Storage conditions and storage periods for the grape field trials were not described. The petitioner will need to specify the storage conditions and storage periods used for the samples from his field trials. The storage information should cover the period from harvest to analysis.

5n. The Dresden, NY, grape field trial resulted in total TM levels of up to 7.66 ppm after 4 treatments at a rate of 0.7 lb. a.i./A and of up to 7.28 ppm after 2 treatments at this rate. Extrapolating to the maximum proposed application rate of 1.05 lb. a.i./A, up to 11.5 ppm total TM could be expected in/on grapes treated according to the label rate. Since no raw data sheets were submitted from the field cooperator, RCB cannot determine whether unusual climatological factors, an erroneous dosage rate, etc., may have been responsible for the residue levels found in the Dresden trial. At this time, RCB concludes that the proposed tolerance of 10 ppm TM/metabolites could be exceeded by the proposed use. This conclusion is subject to reconsideration if the raw data sheets which RCB needs from the field trials should show that there were mitigating circumstances which could explain the magnitude of the residue levels obtained in the Dresden trial.

5o. The petitioner will need to provide a description of the fractionating process used to generate the residue data on grape commodities. For a permanent tolerance, the fractionating process should reflect common commercial practice. If the petitioner can explain the wide range in concentration factors observed for juice and dry pomace, he should do so.

5p. Because residue levels of total TM approaching 8 ppm have been observed on grapes after a 0.67 X application rate, RCB at this time cannot judge whether the proposed feed/food additive tolerances are adequate for raisins and raisin waste .

5q. RCB concludes that a feed additive tolerance is not needed for wet pomace.

5r. At this time RCB reserves judgment on the adequacy of the proposed tolerances for grapes and commodities derived from grapes until problems associated with the grape residue data have been resolved (see Residue Data-Grapes).

5s. RCB has recently questioned the advisability of registering thiophanate-methyl for uses which will result in detectable residues of TM/metabolites in livestock feed items, because analytical methodology capable of determining the resultant bound liver residues is not available (PP #3F2908, Thiophanate-methyl on wheat and onions, memo of K. Arne, 10/4/83). The petitioner is reminded that the tolerance of 0.05 ppm on wheat grain was established because the particular use pattern (limited to winter wheat grown in WA, OR, and ID) did not result in detectable TM/metabolite residues in wheat (PP #3F2908, memo of M. Firestone, 12/20/84). RCB reiterates that it is not advisable to substantially increase the dietary burden imposed upon livestock until a method capable of determining bound residues of concern in all animal commodities is developed; therefore RCB recommends against establishing tolerances for residues of TM/metabolites at this time on rice and grapes.

6a. At this time, RCB reserves its conclusion on the adequacy of the proposed meat and milk tolerances until the residue data and the following issues have been resolved:

1. RCB has deferred to TOX on the need for including 4-OH thiophanate-methyl, a metabolite found in milk, in the tolerance expression (see also the animal metabolism section of this review);

2. The nature of the residue in meat is not adequately understood (see Nature of the Residue section of this review)

3. The acid hydrolysis step used to analyze residues in milk has not been shown to free conjugates (see Analytical Methodology section of this review), and;

4. Current methodology is not capable of adequately determining bound residues in liver and has not yet been shown to be capable of determining residues in kidney.

6b. RCB cannot judge the adequacy of the increased proposed tolerances for residues of TM/metabolites in chicken liver until problems relating to the nature of the residue in liver and the analysis for residues in that organ have been resolved. The available data indicate that residues may concentrate in liver. Moreover, it has not been established that the current analytical methodology is capable of determining residues of concern in liver.

7. Codex has established a tolerance for residues of thiophanate-methyl (expressed as carbendazim--i.e. MBC) on grapes at a level of 10 ppm. If the US tolerance is established at 10 ppm, there would not be a compatibility problem with regard to the tolerance level. However, the US tolerance expression includes thiophanate-methyl, allophanate, and the benzimidazole containing metabolites.

   Canada has established a limit for residues of benomyl, carbendazim, and thiophanate-methyl (expressed as carbendazim) on grapes at 5 ppm, but no Mexican tolerance for residues of TM on grapes has been established.

   Neither Codex, Mexico, nor Canada has established a tolerance for residues of TM/metabolites on rice.

   Codex has established a limit for residues of TM in/on chicken meat and fat at 0.1 ppm. No limit has been established for TM residues in chicken liver. Neither Canada nor Mexico has established a limit for residues of TM in animal commodities.

Recommendations

RCB recommends against the proposed tolerances for residues of thiophanate-methyl/metabolites on grapes, rice, and their processed commodities and against the proposed increased tolerances in milk and the liver and kidney of animals because of reasons given above under Conclusions 1, 2a, 2b, 3b, 3c, 3d, 3e, 4a, 4b, 4c, 4d, 4e, 5a, 5b, 5c, 5d, 5e, 5f, 5g, 5h, 5i, 5j, 5l, 5m, 5n, 5o, 5p, 5r, 5s, 6a, and 6b. Note to PM: TOX should be made aware of RCB's deference on Conclusion 3b above.

Detailed Considerations

Manufacture and Formulation

The formulation proposed for use on rice and grapes is Topsin-M® 70% Wettable Powder, which contains 70% active ingredient. The manufacturing process was submitted with PP #9F2274.

Technical thiophanate-methyl (TM) is 95-96% pure. The impurities are not expected to pose a residue problem. The inerts in Topsin-M® are cleared for use under 40 CFR 180.1001.

Proposed Use

Rice

Topsin-M® is to be applied to rice at the boot stage at a rate of up to 0.7 lb a.i./A. A second application is to be made at heading. Stubble rice is not to be treated. The water drained from the treated area may not be used to irrigate other crops. Topsin-M is not to be used on rice grown in CA. Topsin-M is not to be applied to fields where crayfish or catfish farming is practiced; water from treated fields may not be drained into areas where such farming is practiced. A 21 day PHI is imposed.

Grapes

For control of Botyris Bunch Rot or Powdery Mildew, Topsin-M (1.05 lb. a.i./A) is to be applied to grapes at first bloom (no later than 5% bloom). A second treatment may be made 14 days later. A third application may be made 3-4 weeks before harvest or when sugar begins to build. A fourth application 14 days later is recommended if conditions favorable for disease persist.

East of the Rockies, Topsin-M® is to be applied when foliage first develops. Repeat applications every 14-21 days are permitted until berries are full size. A 7 day PHI is imposed.

According to Dr. Robert Pool (telecon, 2/21/86), Department of Pomology, Cornell University, bud break in NY occurs around May 1st, and harvest takes place from September 1 to October, 25. Since a 7 day PHI is imposed, and applications are permitted from the first appearance of foliage, about 12 applications are theoretically possible. The petitioner will need to specify the total number of applications permitted to grapes in a revised Section B/label. The proposed use should, of course, be supported by appropriate residue data.

Aerial application and ground equipment application are permitted for the use of Topsin-M on grapes and rice. The petitioner should specify the gallonage per acre for aerial applications to grapes and rice.

Nature of the residue

Plants

No new metabolism data were submitted with this petition. However the metabolism of thiophanate-methyl (TM) in plants has been extensively discussed in the memo of A. Smith (PP #9F2274/FAP #9H5241, 8/4/80) and in the Thiophanate-methyl Registration Standard. Investigations of the metabolism of TM by apples, beans, and grapes have established that the terminal residues of toxicological concern are the parent, the oxygen analogue of TM, allophanate, methyl 2-benzimidazole carbamate (MBC), and metabolites containing the benzimidazole moiety. RCB concludes that the nature of the residue in rice and grapes is adequately understood.

Animals

No new metabolism data were submitted with this petition. The following description of ruminant metabolism is summarized from data contained in PP #9F2274 and in RCB's Thiophanate-methyl Subject File. The data are discussed in more detail in the Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard.

Meat and Milk

In a study conducted by the Analytical Development Corp. (ADC), 4 cows were dosed with ^{14}C-phenyl labeled TM at a rate equivalent to 15.5 ppm in the diet for a period of 10-11 days. The residues identified in milk consisted of: parent; 4-OH thiophanate-methyl (13.4% of the identified terminal residues), allophanate, 4-OH allophanate (<2% of the identified residues), MBC, 4-OH MBC, 5-OH MBC, and 2-aminobenzimidazole. These residues comprised about 85% of the total radioactive residues in milk. Most of the conjugates in this study were freed with aryl sulfatase. The values of TM equivalents in milk were reported to range from 0.05-0.12 ppm. The petitioner cautioned that these values had not been corrected for quenching and background and that the samples had not been counted long enough to enable an accurate estimate of TM equivalents in milk. The nature of the residue in these milk samples was delineated in another laboratory, which reported the TM milk residue level to be 0.1 ppm. It was not stated whether these samples had been corrected for quenching.

In the cow metabolism study described above, the following ^{14}C-residue levels, expressed as ppm TM, were found in tissues: liver, 1.061-1.45 ppm; kidney, 0.391-0.528 ppm; muscle, 0.033-0.050 ppm; and fat, 0.036-0.082 ppm. Of the 1.5 ppm TM in the liver, only 0.5 ppm was freely extractable. A previous metabolism study carried out by IBT (of which RCB has no record of validation) had yielded a liver sample containing about 17 ppm TM equivalents; hydrolyses with 15 N phosphoric acid, enzymes, 6 N sodium hydroxide, and finally 6 N hydrochloric acid had failed to convert the radioactive conjugates to identifiable metabolites. Therefore, the bound liver residues from the ADC study were fed to rats. Analysis of the rats' urine and feces showed that 5-OH MBC/conjugates and 5-OH-2-aminobenzimidazole (5-OH-2-AB) accounted for about half of the activity in the bound liver residues. Since attempts to identify the freely extractable residues (which account for about 1/3 of the activity of the liver) had met with little success, only about 35% of the terminal radioactive residues in liver have been identified. Those residues which have been identified in liver, namely 5-OH MBC and 5-OH-2-AB, were identified only after passage through 2 animals (first a cow and then a rat); so it is difficult to determine which animal metabolized the thiophanate-methyl to the terminal residues excreted by the rat. However, the rat study does show that bioavailable residues of toxicological concern are present in bound beef liver residues. The radioactive residues present in fat, muscle, and kidney were not adequately characterized. A radioactive study carried out by IBT (and which has not yet been validated) indicates that analysis of conjugates may also be a problem with beef kidney. Although all the radioactivity was extractable, a kidney which contained 11.2 ppm TM equivalents by radioassay was found to contain only 0.05 ppm TM and 0.12 ppm MBC by chemical assay. Because of the shortcomings of the available metabolism studies, the Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard has cited the inadequacies of the delineation of the terminal residues in meat as a data gap.

According to this IBT study, TM residue levels in milk were:

Feeding level (ppm)	TM equivalents in milk (ppm)
15	0.79
45	2.56
150	9.91

These levels are about 8 times higher than the levels reported in the ADC study. On the basis of the IBT study, a tolerance of 1.0 ppm has been established for residues of TM/metabolites in milk. Therefore, RCB now estimates that the level of TM equivalents in milk could reach 2.5 ppm (assuming a dietary burden of about 42.5 ppm TM--see Residue Data, Meat and Milk section of this review) resulting from the proposed use on rice and grapes.

Although RCB considers the nature of the residue in milk to be adequately understood, 4-OH thiophanate-methyl is not included in the current tolerance expression. Since the level of this residue could range up to 0.3 ppm (0.134 x 2.5 ppm, based on the IBT study), RCB now defers to TOX on the need to regulate 4-OH thiophanate-methyl in milk.

The Residue Chemistry Chapter of the Registration Standard (2/15/85) indicates that more work needs to be done in describing the nature of the residue in muscle, fat, kidney, and liver of ruminants.

RCB concludes that the nature of the residue in meat is not adequately understood for the proposed use, which could lead to residues of TM/metabolites of up to 125 ppm on livestock feed items (e.g., grape pomace and raisin waste).

Poultry and Eggs

Hens were dosed with ^{14}C-thiophanate-methyl for 10 days at a rate equivalent to 50 ppm in the diet. Radioactive residues in eggs plateaued after 7 days and were present at a level equivalent to 0.26 ppm TM after 10 days. It was found that 72-100% of the terminal radioactive residues consisted of MBC and 5-OH MBC. At 3-4 days, the 5-OH MBC/MBC ration was about 3:1; at 8 days the 5-OH MBC/MBC ratio was about 1:2.

The terminal residues identified in muscle tissue were MBC, 5-OH MBC, and 5-OH MBC sulfate. The per cent of the terminal radioactive residues identified in muscle tissue was not given. Terminal residues in fat and liver were not identified. Liver tissue was not examined in this study although ruminant metabolism studies had indicated that bound residues in liver could be a problem. Moreover an IBT study (of which RCB has no record of validation) indicated that radioactive residues concentrate in poultry liver and kidney. The Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard requests additional data depicting the nature of the residue in poultry tissues.

RCB concludes that the nature of the residue in eggs is adequately understood. The residues of toxicological concern are the parent, its oxygen analogue allophanate, and residues containing the benzimidazole moiety. RCB further concludes that the nature of the residue in poultry tissue is not adequately understood for the purpose of the proposed use on grapes and rice; feed commodities associated with grapes and rice may be fed to poultry.

Analytical Methodology

TM + MBC in Plants

Residue data on grapes and rice were generated by the PAM II UV method used for a variety of fruits and vegetables. The sample was extracted with acetone and concentrated on a rotatory evaporator. The pH of the remaining aqueous solution was adjusted to pH 6.5-7.0. After extraction with dichloromethane and removal of the solvent, the residue was treated with acetic acid and cupric acetate at 120-130° to convert TM to MBC. After acidification the reaction mixture was washed with heptane, then extracted with chloroform to remove the allophanate which was determined separately (see below). Residues of MBC were cleaned up by liquid-liquid partitioning, extracted into sulfuric acid solution, and the acid solution was examined spectrophotometrically from 240-300 nm. A baseline was drawn connecting the absorbance at 290 nm to the absorbance at 260 nm. The peak height at 281 nm was measured, and the MBC residues were determined with a standard curve. If interferences below 270 nm were encountered, a different baseline was drawn, and the absorbance at 290 nm was subtracted from the absorbance at 281 nm to quantitate the amount of MBC.

Allophanate

The chloroform extract containing allophanate (see above) was concentrated, and allophanate residues were cleaned up by Florisil column chromatography before analysis by HPLC using a UV detector (254 nm).

An HPLC method that determines TM, MBC, and allophanate was also described in the Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard.

Rice commodities were fortified with TM (0.05-2.0 ppm), MBC (0.2-1.0 ppm), or with TM (0.025-1.0 ppm) plus MBC (0.01-0.5 ppm).

The recoveries of total TM from rice commodities and the reported sensitivities are tabulated below.

Commodity	Fortification level		Recovery	Sensitivity (ppm)
	TM (ppm)	MBC (ppm)		
Rough rice	0.025-1.0	0.01-1.0	70-100%	0.025
Straw	0.2-2.0	0.1-0.5	60-78%	0.05
Milled rice	0.025-0.10	0.01-0.25	80-94%	0.025
Brown rice	0.025-0.5	0.01-0.25	65-79%	0.025
Hulls	0.025-0.5	0.01-0.5	53-96%	0.05
Bran	0.05-0.5	0.02-0.25	51-74%	0.05
Polish	0.08-1.0	0.03-0.25	56-80%	0.1

The petitioner has submitted UV spectra of check samples and fortified samples (with TM or TM + MBC) of brown rice, milled rice, rice hulls, and bran. Spectra of check samples of rough rice, rice polish, and rice straw have not been submitted.

The recoveries of total TM and allophanate from grape commodities are tabulated below.

Commodity	Fortification level (ppm)			% Recovery	
	TM	MBC	Allophanate	TM	Allophanate
Whole fruit	0.1-1.0	0.05-0.25	0.2-1.0	60-93	57-70
Juice	0.1-0.5	0.05-0.25	0.2-1.0	58-100	40-83
Wet pomace	0.1-2.0	0.05-0.25	0.2-1.0	55-96	50-77
Dry pomace	0.5-2.5	0.25-1.25		52-75	
Raisins	0.5	0.25		53-63	
Raisin waste	0.5	0.25		57-66	

Maximum total TM residue levels in check samples in grape commodities are given below.

Commodity	Maximum total TM residue level (ppm) in check samples
Whole fruit	0.10
Juice	0.05
Wet pomace	0.08
Dry pomace	0.22
Raisin	0.07
Raisin waste	0.17

The petitioner has submitted UV spectra of check and fortified samples of whole fruit, juice, and wet pomace, dry pomace, raisins, and raisin waste.

RCB concludes that the methodology used to generate residue data on grapes and rice was adequate for data collection. However, the Residue Chemistry Chapter (2/15/85) of the Thiophanate-methyl Registration Standard questions the adequacy of the spectrophotometric methodology for enforcement purposes. Residues of TM are determined on the basis of the absorption at 281 nm; since many aromatic molecules absorb in this region, interference by other pesticides or from components of the crop matrix could arise.

To eradicate any thought of interference by other pesticides, the Residue Chemistry Chapter of the Registration Standard concluded the following:

> "We therefore cannot accept the UV procedures as enforcement methods without data that validate the lack of interference of pesticides other than TM with TM residue analysis. An HPLC method that determines TM, MBC, and allophanate (MRID 00036809) appears to be an easier, more efficient and perhaps more specific method for determination of these residues. We suggest the registrant submit this method (and supporting recovery data) as a replacement for the current UV enforcement method for determination of residues in plants."

For the establishment of tolerances on rice and grapes, RCB concludes that the petitioner needs to fulfill the preceding.

Meat, Milk, Poultry, and Eggs Analytical Methodology

The proposed use on rice and grapes could result in residues of up to 125 ppm TM/metabolites on grape pomace and raisin waste, which are feed items. Although a successful method trial was conducted for residues of TM/metabolites in animal tissues, eggs, and milk (PP #9F2274, memo of K. Zee, 1/9/81), RCB has recently questioned the capability of the methodology used in the method trial for determining bound residues of toxicological concern in liver (PP #3F2908, memo of K. Arne, 10/4/83). The available data (see Nature of the Residue section of this review) indicate that methodology capable of determining bound residues in beef liver is not available. Bound residues in liver were freed only following digestion by a rat. RCB also notes that there is no confirmation that the available methodology is capable of determining residues of concern in beef kidney.

RCB concludes that adequate methodology for the analysis of animal tissues for residues of TM and the metabolites of concern identified thus far is not available. Furthermore, the nature of the residue in meat and poultry is not adequately understood. Should other metabolites of toxicological concern be identified, additional methodology will have to be developed.

RCB has deferred to TOX on the need for regulating residues of 4-OH TM, which may constitute up to 13% of the terminal residues in milk. Should TOX conclude that this metabolite is of concern, appropriate analytical methodology may need to be developed.

RCB reserves judgment on the adequacy of the procedure used to determine residues of TM/metabolites in milk. The Thiophanate-Methyl Registration Standard questions the ability of the current methodology for freeing conjugates of regulated residues. The hydrolysis of conjugates by acid, as specified in the protocol, has not been confirmed. The Registration Standard notes that in the metabolism studies, the major portion of the conjugates was hydrolyzed by enzymes.

At this time, RCB tentatively concludes that adequate methodology is available for the analysis of TM/metabolites in eggs.

Residue Data

Rice

The rice residue data described below were submitted with PP #2F2729 and PP #2G2662. Residue data on rough rice (rice with hulls) and rice straw were generated from 16 field trials conducted in the states of TX, AR, and LA. These states produce about 68% of the nation's rice. The field trials were carried out from 1973-1981. Rice received 1-3 applications of Topsin at a rate of 0.25-0.7 lb. a.i./A. The maximum proposed use consists of 2 applications (at the boot stage and at heading) at a rate of 0.7 lb. a.i./A. PHI's of 21-51 days were observed (proposed PHI, 21 days). The residue data reflect both aerial and ground equipment application. The interval between treatments ranged from 9-32 days.

Storage stability data submitted with PP #9F2274 indicate that weathered residues of TM/MBC showed no significant deterioration after periods of frozen storage ranging up to 38 months. Although the petitioner has not specified either the storage conditions or the storage periods for his rice commodities, the dates on his spectra seem to indicate that samples from the 1981 field trials were stored for several months before analysis. The petitioner will need to specify the storage conditions and storage periods used for the samples from his field trials. Some studies were conducted 13 years ago. The storage information should cover the period from harvest to analysis.

The residue data on rough rice and straw are tabulated below.

Application rate (lb. a.i./A)	Air or ground	Number of treatments	PHI (days)	Total TM (ppm) corrected for recovery
Rough rice				
0.25	G	2	25-41	<0.05
*0.7	G	2	21-30	<0.025-0.05
0.7	G	2	35-49	<0.05-0.07

Application rate (lb. a.i./A)	Air or ground	Number of treatments	PHI (days)	Total TM (ppm) corrected for recovery
Rough rice				
*0.7	A	2	30	<0.025
0.7	A	2	34-45	**0.03-0.21
0.7	G	3	51	0.03
Straw				
*0.7	G	2	30	1.36
0.7	G	2	34-45	0.34-0.81
0.7	A	2	34-45	0.23-3.93

*Approximate proposed use--proposed PHI, 21 days

**Table 1, PP #2G2662 lists residue levels of 0.025 ppm (uncorrected) and 0.03 ppm (corrected). However, the description of Test No. 1, Bay City, TX (page D-31 of PP #2G2662) indicates that the TM residue level was 0.3 ppm.

RCB cannot accept a label restriction against use of Topsin in CA because California produces approximately 24% of the nation's total rice, a major crop. For short and medium grains, CA's rice production exceeds the other rice growing states. Therefore residue data from CA are required. Almost 4 years ago, the petitioner was informed that he would need to submit residue data generated on rice grown in CA for the establishment of a permanent tolerance on rice (see RCB's 8/16/82 review of PP #2G2662). The locations of the field experiments should reflect all of the principal growing regions of the crop as indicated in the annual USDA publication Agricultural Statistics, even if no pest pressure currently exists in some of the major growing areas. The petitioner should conduct his CA field trials so that they reflect his intended 21 day PHI. None of the submitted rice straw field trials reflect a 21 day PHI.

Raw data sheets from the field trial cooperators have not been submitted. The petitioner should supply these data sheets so that RCB can validate the treatment rates, PHI's of the field trials, storage conditions of the field samples, etc. These sheets can also furnish pertinent climatological data which may help to explain any aberrant residue levels.

At this time RCB reserves judgment on the appropriateness of the proposed tolerance for residues of TM/metabolites on rice and straw arising from the proposed use until the receipt of information on storage conditions of the field samples and residue data from CA. The residue data from CA should include some analyses of rice samples for the metabolite allophanate.

No residue levels of allophanate were submitted on rice. Metabolism data submitted with PP #9F2274 indicate that this residue usually accounts for less than 10% of the terminal residues. The crops investigated were: cucumbers, tomatoes, grapes, peach, citrus, and wheat, which is a member of the same crop grouping as rice. However, RCB reserves judgment on the need for more allophanate residue data on rice until the CA data have been submitted.

Processed Rice Commodities

Five rice samples were processed into fractions. The residue data from the processing studies involving rice bearing detectable residues are tabulated below. "Rough rice" refers to rice with hulls; "brown rice" refers to the rice kernel with the hull removed; "milled rice" refers to the kernel with the hull, bran, and polishings removed.

ppm Total TM (corrected for recoveries)

Rough	Brown	Milled	Hulls	Bran	Polish
*0.3	<0.025	<0.025	0.10-0.25	<0.05	<0.1
0.21	<0.025	<0.025	0.45-0.55	<0.05	<0.1
0.05	<0.025	<0.025	0.24	<0.05	<0.1

*This residue level is given as 0.03 ppm in Table 1 of PP #2G2662.

The only commodity in which residues of concern concentrate is rice hulls. The value of the concentration factor depends upon the residue level in the sample from Bay City, TX. This sample is variously described as exhibiting total TM levels of 0.3 ppm and 0.03 ppm. The petitioner will need to address this discrepancy.

At this time RCB can make no judgment on the adequacy of the proposed tolerance for residues of TM/metabolites on rice hulls until problems associated with the rice residue data have been resolved (CA residue data; storage conditions).

Grapes

Residue data from 28 field trials were submitted with PP's #2G2639 and #2F2729. The field trials were conducted in the states of CA, PA, and NY. These states produce 96% of the nation's fresh grapes (Census of Agriculture, 1982). A multiplicity of PHI's and dosage rates were employed; grapes were harvested 0-146 days after receiving 1-7 applications of Topsin at rates ranging from 0.53-2.1 lbs. a.i./A. The data reflect aerial and ground equipment application.

According to the submitted label, grapes may be treated "as needed" at a rate of 1.05 lb. a.i./A at 14-21 day intervals, provided that a 7-day PHI is observed.

The grape residue data reflecting PHI's of 0-21 days are tabulated below.

Rate lbs. a.i. per acre	PHI (days)	Total TM (ppm) [# of treatments]	Allophanate (ppm)
0.7	0	1.01[4]- 8.77[2]	
1.05	0-3	0.57[6]- *4.00[3]	
1.5	0	1.26[7]	
2.1	0-3	2.09[4]	
†0.7-0.75	7-8	0.77[6]- 7.66[4]	
1.05	5-8	0.58[6]- 1.91[3]	
1.4-1.5	5-7	0.21[3]- 3.75[3]	
2.1	6	1.75[4]	0.06
2.1	8	1.50[6]	
0.53	20-21	0.28[3]- 0.59[3]	
1.05	11-13	0.03[5]- 1.54[3]	
1.5	24	0.54[1]	
2.1	12	0.76[4]	

†Proposed rate

*The dosage rate appears as "1.08-5 lbs. a.i./A" in the summary table (page D-13 in PP #2G2639, amendment of 1/24/83). RCB questions this dosage rate because only one residue level value was given and because the 5 lb rate is markedly higher than the other treatment rates. The petitioner should verify the dosage rate in this trial (Biglerville, PA, Sample No. 67-T).

No raw data sheets from the field cooperators were submitted so that RCB can check the dosage rate used in the Biglerville, PA, trial. Raw data sheets from the field cooperators should always be submitted so that RCB can validate the treatment rates, PHI's of the field trials, storage conditions of the field samples, etc. These sheets can also furnish pertinent climatological data which may help to explain any aberrant residue levels.

The residue data for residues of total TM on rice reflected corrections for recovery; the residue data submitted in January, 1983, for grapes as part of PP #2G2639 were not corrected for recoveries, and the petitioner did not specify whether the residue data submitted with PP #2F2729 and with the initial submission of PP #2G2639 were corrected for recoveries. The petitioner will need to specify whether the latter data were corrected for recoveries.

Residue levels of allophanate were determined in only 2 field trials (one of which reflected a 146 day PHI). In these trials, allophanate was found to constitute up to 3% of the residues determined. Allophanate residue data on grapes submitted with PP #9F2274 corroborate this result; allophanate residues constituted 2-6% of the residues determined 1-30 days after application. Therefore RCB is not requesting additional allophanate residue data on grapes.

According to Dr. Robert Pool (telecon, 2/21/86), Department of Pomology, Cornell University, bud break in NY occurs around May 1st, and harvest takes place from September 1 to October, 25. Since a 7 day PHI is imposed, and applications are permitted from the first appearance of foliage, about 12 applications are theoretically possible, although the residue data only reflect up to 7 applications. If the petitioner intends to permit more than 7 applications, he will need to submit additional residue data reflecting his intent. The petitioner also has the option of limiting the total number of applications permitted to grapes to 7 applications in a revised Section B/label.

Storage conditions and storage periods for the grape field trials were not described. The petitioner will need to specify the storage conditions and storage periods used for the samples from his field trials. The storage information should cover the period from harvest to analysis.

In the 12 field trials approximating the proposed 7-day PHI, total residues of TM in/on grapes were <4 ppm with application rates ranging up to approximately 1.5 X the proposed rate, with the exception of the field trial in Dresden, NY. This trial resulted in total TM levels of up to 7.66 ppm after 4 treatments at a rate of 0.7 lb. a.i./A and of up to 7.28 ppm after 2 treatments at this rate. Extrapolating to the maximum proposed application rate of 1.05 lb. a.i./A, up to 11.5 ppm total TM could be expected in/on grapes treated according to the label rate. Since no raw data sheets were submitted from the field cooperator, RCB cannot determine whether unusual climatological factors, an erroneous dosage rate, etc., may have been responsible for the residue levels found in the Dresden trial. At this time, RCB concludes that the proposed tolerance of 10 ppm TM/metabolites could be exceeded by the proposed use. This conclusion is subject to reconsideration if the raw data sheets which RCB needs from the field trials should show that there were mitigating circumstances which could explain the magnitude of the residue levels obtained in the Dresden trial.

Grape Fractionation Studies

Residue data from one field trial reflecting analyses of raisins for total TM residues and for allophanate had been provided with the original submission of PP #2G2639. Grapes had received 4 treatments at a rate of 1.05 or 2.1 lb. a.i./A; grapes were harvested 6 days after treatment and were sun dried for 27 days. At the higher treatment rate, the residue level of total TM was 5.68 ppm; the residue level of allophanate was 0.11 ppm or 2% of the residues determined. At the lower rate, the residue level of total TM was 2.02 ppm; allophanate residues were below the limit of detection (<0.05 ppm).

Additional residue data on grapes, grape juice, wet and dry pomace, raisins, and raisin waste were submitted with the 1/24/83 amendment to PP #2G2639. Raisins received 1-4 applications of thiophanate-methyl at rates of 1.05-1.5 lb. a.i./A. According to the summary table, the field trial at Biglerville, PA, received 1.08-5 lb./A. The petitioner will need to verify this dosage rate (see Residue Data-Grapes). Grapes exhibited total TM residue levels of 0.21-4.00 ppm.

The concentration factors for the various grape commodities (relative to grapes) are given below.

Commodity	Concentration Factor (relative to grapes)
Juice	0.15-4.04
Wet pomace	0.14-0.96
Dry pomace	0.20-2.9
Raisins	2.2-*8.3
Raisin waste	15-21

*Based on UV scan No.29, which gives 1.75 ppm as total TM level (summary table value for this sample, 58-T, is 1.29 ppm).

The petitioner will need to provide a description of the fractionating process used to generate the residue data on grape commodities. For a permanent tolerance, the fractionating process should reflect common commercial practice. If the petitioner can explain the wide range in concentration factors observed for juice and dry pomace, he should do so. Of the 8 juice studies submitted, 2 juice samples showed a concentration of residues in juice.

Because residue levels of total TM approaching 8 ppm have been observed on grapes after a 0.67 X application rate, RCB at this time cannot judge whether the proposed feed/food additive tolerances are adequate for raisins and raisin waste .

RCB concludes that a feed additive tolerance is not needed for wet pomace.

At this time RCB reserves judgment on the adequacy of the proposed tolerances for grapes and commodities derived from grapes until problems associated with the grape residue data have been resolved (see Residue Data-Grapes).

In addition to the adequacy of the proposed tolerances on grapes, rice, and their associated commodities, RCB must also consider the appropriateness of such tolerances. RCB has recently questioned the advisability of registering thiophanate-methyl for uses which will result in detectable residues of TM/metabolites in livestock feed items, because analytical methodology capable of determining the resultant bound liver residues is not available (PP #3F2908, Thiophanate-methyl on wheat and onions, memo of K. Arne, 10/4/83). The petitioner is reminded that the tolerance of 0.05 ppm on wheat grain was established because the particular use pattern (limited to winter wheat grown in WA, OR, and ID) did not result in detectable TM/metabolite residues in wheat (PP #3F2908, memo of M. Firestone, 12/20/84). RCB reiterates that it is not advisable to substantially increase the dietary burden imposed upon livestock until a method capable of determining bound residues of concern in all animal commodities is developed; therefore RCB recommends against establishing tolerances for residues of TM/metabolites at this time on rice and grapes.

Meat, Milk, Poultry, and Eggs

Meat and Milk

The following permanent tolerances for thiophanate-methyl/metabolites have been established on animal commodities:

Commodity	Established Tolerance (ppm)
Milk	1.0
Liver of swine and horse	1.0
Liver of cattle, goats, and sheep	2.5

Commodity	Established Tolerance (ppm)
Kidney of cattle, goats, and sheep	0.2
Meat, fat, and meat by-products (except liver and kidney) of cattle, goats, and sheep	0.1
Meat, fat, and meat by-products (except liver) of swine, and horse	0.1

If the assumption is made that residues on feed items will be at tolerance levels, beef and dairy cattle could be subjected to the following dietary burdens:

Beef Cattle

Feed item	Tolerance (ppm)	% in Diet	PPM in diet
Bean forage	50	20	10
Dried grape pomace	125	30	37.5
Wheat grain	0.2	50	0.1
			47.5

Dairy Cattle

Feed item	Tolerance (ppm)	% in Diet	PPM in diet
Bean forage	50	35	17.5
Dried grape pomace	125	20	25
Wheat grain	0.2	45	.09
			42.59

A cattle feeding study, conducted by ADC, was submitted with PP #9F2274. Cattle were fed ^{14}C-TM at a level equivalent to 15.5 ppm in the diet for 10-11 days. The following levels of activity were observed:

Site	Activity (TM equivalents)
Liver	1.1-1.5
Kidney	0.4-0.5

Site	Activity (TM equivalents)
Muscle	0.03-0.05
Fat	0.03-0.08
Milk	0.05-0.12

In its review of the 1/24/83 amendment to PP #2G2639, RCB (memo of S. Malak, 5/27/83) recommended that tolerances in meat and milk be increased to the following levels in order to accommodate the increased dietary burden resulting from the proposed use on grapes:

Milk	2.0 ppm
Liver of cattle, goats, hogs, horses, and sheep	5.0 ppm
Kidney of cattle, goats, hogs, horses, and sheep	0.5 ppm

However, at this time, RCB reserves its conclusions on the adequacy of the proposed meat and milk tolerances until the residue data and the following issues have been resolved:

1. RCB has deferred to TOX on the need for including 4-OH thiophanate-methyl, a metabolite found in milk, in the tolerance expression (see also the Animal Metabolism section of this review);

2. The nature of the residue in meat is not adequately understood (see Nature of the Residue section of this review)

3. The acid hydrolysis step used to analyze residues in milk has not been shown to free conjugates (see Analytical Methodology section of this review), and;

4. Current methodology is not capable of determining bound residues in liver and has not yet been shown to be capable of determining residues in kidney.

Poultry and Eggs

A tolerance for residues of TM/metabolites was established at a level of 0.1 ppm in/on eggs and poultry tissues except for liver, where the tolerance was established at a level of 0.2 ppm. A dietary burden imposed upon poultry by proposed and established uses is given below:

Turkeys and Broilers

Feed item	Tolerance (ppm)	% in Diet	PPM in diet
Grape pomace	125	5	6.25
Rice with hulls	5	40	2.0
Wheat grain	0.2	55	0.11
			8.36

Laying Hens

Feed item	Tolerance (ppm)	% in Diet	PPM in diet
Grape pomace	125	5	6.25
Rice with hulls	5	20	1.00
Wheat grain	0.2	50	0.1
			7.35

A poultry feeding study conducted by Pennwalt had been previously submitted with PP #9F2274. Laying hens, fed ^{14}C-thiophanate-methyl at a level equivalent to 50 ppm in the diet for 10 days exhibited the following levels of activity:

Site	Activity (ppm TM equivalents)
Eggs	0.26
Fat	0.01
Muscle	0.04

Radioactive residues in eggs plateaued at day 7.

In an earlier study conducted by IBT, hens fed ^{14}C-TM at the same rate as above (50 ppm) for 30 days exhibited the following levels of activity:

Site	Activity (ppm TM equivalents)
Eggs	0.38
Fat	ND
Muscle	ND
Liver	1.59
Kidney	1.22

On the basis of the above studies, RCB (PP #2G2639, memo of S. Malak, 5/27/83) recommended that a tolerance of 0.4 ppm for residues of TM/metabolites in poultry liver would be more appropriate.

However, at this time RCB does not consider it advisable to further discuss the tolerance for levels of TM/metabolites in poultry liver until the nature of the residue in liver has been characterized. The IBT study indicates that residues may concentrate in liver. RCB notes that the residue levels in eggs from the Pennwalt study and from the IBT study are virtually identical and that the residues in muscle and fat are very low to non-detectable in both studies. Moreover, it has not been established that the current analytical methodology is capable of determining residues of concern in liver.

Other Considerations

Codex has established a tolerance for residues of thiophanate-methyl (expressed as carbendazim--i.e. MBC) on grapes at a level of 10 ppm. There will not be a compatibility problem between the US and Codex with regard to the tolerance level of 10 ppm on grapes. However, The US tolerance expression expression includes thiophanate-methyl, allophanate, and the benzimidazole containing metabolites.

Neither Codex, Mexico, nor Canada has established a tolerance for residues of TM/metabolites on rice.

Canada has established a limit for residues of benomyl, carbendazim, and thiophanate-methyl (expressed as carbendazim) on grapes at 5 ppm. Mexico has not established a tolerance for residues of TM on grapes. Codex has established a limit for residues of TM in/on chicken meat and fat at 0.1 ppm. No limit has been established for TM residues in chicken liver. Neither Canada nor Mexico has established a limit for residues of TM in animal commodities.

cc:TOX, EEB, EAB, PMSD/ISB, PM #21, CIRCU, PP #6F3343, R.F., Reviewer-Deyrup, FDA
RDI: JOnley:4/22/86:RDSchmitt:4/22/86
TS-769:RCB:CM#2:RM810:X7484:CDeyrup:cd:4/22/86

J. Lues 3/28/86

INTERNATIONAL RESIDUE LIMIT STATUS

CHEMICAL Thiophanate - Methyl

CCPR NO. 77

PETITION NO. 6F 3343

Reviewer: Deyrup

Codex Status

/ / No Codex Proposal
Step 6 or above

Residue (if Step 9): Thiophanate - methyl expressed as carbendazim 1/

Proposed U.S. Tolerances

Residue: thiophanate - methyl, allophanate, + benzimidazole containing metabolites

Crop(s)	Limit (mg/kg)
grapes	10

Crop(s)	Tol. (ppm)
Grape Pomace, dried	125 ppm
Raisins	50 ppm
Raisin Waste	125 ppm
Rice Hulls	20 ppm
Grapes	10 ppm
Rice	5 ppm
Rice Straw	15 ppm

CANADIAN LIMIT

Residue: benomyl, carbendazim and thiophanate - methyl expressed as carbendazim

Crop	Limit (ppm)
grapes	5

MEXICAN TOLERANCIA

Residue:

Crop	Tolerancia (ppm
none	

NOTES:

1/ "Expressed as carbendazim (MBC), but MBC residues aren't included in the limit. Separate Codex limits for MBC (also 10 ppm on grapes) cover MBC residues resulting from use of thiophanate-methyl, benomyl or MBC.

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CHEMICAL Thiophanate-Methyl

PETITION NO 6F 33[illegible]3

Pleyrup

CCPR NO.

Codex Status

[ ] No Codex Proposal
Step 6 or above

Residue (if Step 9):
as p. 1

Crop(s)	Limit (mg/kg)
chicken meat	0.1*
chicken fat	0.1*

Proposed U. S. Tolerances

Residue: thiophanate-methyl, allophanate, + benzimidazole containing metabolites

Crop(s)	Tol. (ppm)
Milk	2 ppm
Cattle, kidney	0.5 ppm
Cattle, liver	5 ppm
Goats, kidney	0.5 ppm
Goats, liver	0.5 ppm
Hogs, kidney	0.5 ppm
Hogs, liver	5 ppm
Horses, kidney	0.5 ppm
Horses, liver	5 ppm
Sheep, kidney	0.5 ppm
Sheep, liver	5 ppm
Poultry, liver	0.4 ppm

CANADIAN LIMIT

Residue:

Crop	Limit (ppm)
none on animal products	

MEXICAN TOLERANCIA

Residue:

Crop	Tolerancia (ppm)
none on animal products	

Notes: * at or about the limit of determination.
Poultry liver is not included in the Codex limits

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