



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

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Follow-up to Methyl Bromide Registration Standard.
Protocol for the Postharvest Fumigation of Grapes
and Green Cocoa Beans (DEB #5115) No MRID. No.

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Background

The Residue Chemistry Chapter (3/28/86) of the Methyl Bromide Registration Standard had cited the need for residue data reflecting the postharvest fumigation of grapes and green cocoa beans. A protocol for generating residue data on postharvest fumigated grapes was reviewed by DEB in connection with this data call-in (memo of C. Deyrup, 9/23/88).

The Methyl Bromide Registration Standard also cited the need for residue data on processed fractions from fumigated cocoa beans bearing detectable residues of MeBr.

On 2/6/86, the Methyl Bromide Industry Panel (MBIP) submitted an amendment to PP #5F3300 requesting a tolerance of 10 ppm MeBr on green cocoa beans fumigated postharvest with MeBr.

This amendment was reviewed by DEB on 6/16/86 by W. Hazel, after the issuance of the Registration Standard.

Executive Overview of Protocol Deficiencies

I. Grapes

1. Chamber fumigation of grapes may also be needed.
2. Residue data reflecting the lowest temperatures expected during fumigation, storage, and aeration are needed.
3. The residue data should reflect MeBr levels in grapes entering interstate commerce.
4. The mode of aeration should be clarified.
5. The effect of packaging on MeBr levels should be taken into account.
6. The effect of load factor on MeBr levels should be addressed.
7. The protocol should include replicate fumigations.
8. The registrant needs to determine the number of fumigations grapes may receive.
9. MeBr storage stability data may be needed.
10. Analytical methodology should be submitted.
11. The protocol should describe any precautions taken to avoid loss of MeBr during sample preparation.
12. Residue data on wet pomace and juice from treated grapes are needed.
13. Residue data on raisins and raisin waste will be needed if raisins are fumigated.
14. Additional residue data may be needed, once the nature of the residue is understood.

II. Green Cocoa Beans

1. Did the submitted cocoa bean processing study reflect typical commercial practice?
2. If roasted beans are fumigated, roasted fumigated beans should be processed.
3. The fumigation should reflect the registered use.
4. The type of aeration should be specified.

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5. MBIP needs to clarify the number of decline studies in the protocol.
6. The following deficiencies were cited under Grapes and also apply to cocoa beans.
 - a. Analytical Methodology
 - b. Load factor
 - c. Temperature
 - d. Number of fumigations cocoa beans may receive
 - e. Replicate fumigations
 - f. Storage stability data
 - g. Nature of the residue

Summaries of DEB's Comments/Conclusions, re: Table Grapes Protocol

In meetings with the registrant and in numerous subsequent reviews, many of the issues cited in DEB's 9/23/88 review had been addressed.

Most of these issues were not addressed in the present submission; some issues, such as the storage periods, have been changed so often in meetings and various submissions, including this one, that DEB can't be sure that any of the issues which had been agreed upon with the registrant still hold sway.

Therefore, in revising the grape protocol, each issue should be specifically addressed within the framework of the grape protocol so that DEB will know how the grapes will be handled.

The issues cited below are discussed in detail in the main body of the review.

1. Based on "prestudy" results submitted by the registrant, DEB concludes that fumigation under a tarp may not represent the worst case.

If chamber fumigation of grapes is insignificant compared to tarp fumigation (i.e., $\leq 5\%$), DEB could consider restricting grape fumigations to tarp fumigations.

Otherwise, DEB needs bridging data to determine whether residue levels in grapes fumigated in chambers are similar to levels in grapes fumigated under tarps. This time, the MeBr levels should be maintained at the recommended levels during the fumigation.

If chamber fumigation results in higher MeBr levels in grapes,

and if chamber fumigation of grapes is commercially significant, then residue data reflecting chamber fumigation would be needed.

2. Vacuum fumigation of grapes will not be needed.
3. The registrant should conduct the fumigations when the temperature is 50°F or less or demonstrate that the commodity temperature was maintained at 40-49°F (the temperature given in the Plant Protection and Quarantine Treatment Manual).
4. The aeration temperature should reflect the worst case expected in commercial practice. In estimating the worst case, the registrant should consider the time of year when Chilean grapes enter the US (winter) and the current practice of transferring grapes to refrigerated trucks directly after forced aeration (R. Cole, APHIS, Port Operations).

DEB suggests that the registrant determine whether lengthening the current aeration period before refrigeration is commercially feasible. If it is feasible, then residue data reflecting the worst case ambient aeration temperatures are needed.

If it is not feasible, the registrant may need to generate residue data reflecting the decline of MeBr residues under cold storage conditions.

The registrant should document his sources in his response.

5. DEB was informed that the tarps can't be removed until MeBr residues in the airspace have dropped to an acceptable level after a period of forced aeration (R. Cole, APHIS, Port Operations). The registrant will need to clarify the mode of aeration in the protocol, which should reflect common commercial practices.
6. According to J. Fons, USDA/APHIS, Chilean grapes are often shipped with plastic (PVC) liners. The residue data will need to reflect this use, as plastic liners have been shown to lead to higher residue levels with some commodities.
7. The registrant should specify whether the introduction of MeBr will follow commercial practices.
8. The MBIP should address the effect of load factor, which appears to influence residue levels.

According to J. Fons, USDA/APHIS, load factors do not vary much with tarp fumigation, because the framework skeletons underneath the tarps are adjustable. If it is commercially practical to limit grape fumigations to tarp fumigations, then load factors should be selected so as to cover 95% of tarp-fumigated grapes.

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Otherwise, the effect of load factor should be determined, and residue data reflecting the worst commercial case would be needed.

The registrant will need to document his sources to support the selection of load factors.

9. The need for replicate fumigations and for justifying the number of fumigations to grapes (one) were issues which were not addressed in this protocol and remain outstanding.

If more than 5% of fumigated grapes receive more than one treatment, the protocol may need to reflect this commercial practice. The registrant should support his position with documentation.

10. If it is necessary to base the tolerance on an aeration period, samples should not be available for sampling by FDA inspectors before this time has elapsed.

At the meeting of 11/10/88, the registrant said that the USDA will prepare information assessing at what point after fumigation commodities could be sampled by FDA inspectors. This information has not yet been submitted. DEB will need this information to determine the suitability of any proposed aeration period.

11. DEB needs to know when commodities could be sampled by the FDA following fumigation and aeration to determine the need for storage stability data.
12. MBIP needs to submit the analytical methodology. Given the potential for loss of the analyte during the chopping steps, precautions to minimize loss of MeBr during this step should be specifically described.
13. Table grape varieties may be processed. The registrant will need to determine whether residues of MeBr concentrate in the wet pomace and juice from fumigated grapes bearing detectable residues.

For the proposed use on grapes, residue data will not be needed on raisins, and raisin waste. It will be necessary to generate residue data on raisins and raisin waste if raisins are fumigated.

14. The registrant may analyze for residues of MeBr only, but until the metabolism studies have been completed, the issue regarding the nature of the residue remains outstanding. Residue data on inorganic bromide (iBr) are not needed.
15. MBIP should heed RCB's comments contained in previous memos and in the Registration Standard regarding the generation

of residue data for post harvest use.

Summaries of DEB's Comments/Conclusions, re: Cocoa Bean Protocol

1. If the roasting process in MBIP's PP #5F3300 approximated typical commercial conditions, a food additive tolerance would not be needed for the postharvest use on green cocoa beans. This situation may change if the ongoing metabolism studies identify other residues of concern besides MeBr.
2. MBIP will need to provide evidence that roasted cocoa beans are or are not fumigated. If >5% of US chocolate is derived from fumigated roasted cocoa beans, then MeBr residue data may be required on the roasted beans, cocoa powder and chocolate processed from fumigated roasted beans.
3. The section of the protocol dealing with the processing of cocoa beans is very well designed and may be adapted to generating residue data on cocoa fractions from fumigated roasted cocoa beans, should that be necessary.
4. The residue data needs to reflect the registered use, which corresponds to 1.5 lb ai/ 1000³ for 12 hours, unless the MBIP proposes to change the dosage.
5. The deficiencies cited below were discussed in detail in the grape protocol section of this review and also pertain to cocoa beans. The registrant is referred to the the relevant portions of DEB's Comments/ Conclusions, re: Protocol for Table Grapes.
 - a. DEB's concerns regarding the effect of load factor, fumigation temperature, aeration temperature, commodity temperatures, the number of treatments cocoa beans are apt to receive, replicate fumigations, and storage conditions following fumigation, also pertain to cocoa beans.
 - b. The type of aeration should be specified.
 - c. DEB needs to know when commodities could be sampled by the FDA following fumigation and aeration.
 - d. DEB recommends that the beans be analyzed within 2-3 hours in order to avoid the need for storage stability data.
 - e. MBIP may proceed with analyses of MeBr, but until the metabolism studies are completed, the issue regarding the nature of the residue remains outstanding. There is no longer a need for residue data on iBr.
6. In addition, DEB wants to know whether one or two decline studies are scheduled in the current protocol.

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7. The MBIP will need to submit Forms A and B so that DEB will know what sort of postharvest fumigation data and postharvest data the registrant plans to submit.

Recommendations

DEB recommends that the registrant revise the protocols in order to incorporate DEB's comments. In revising the protocols, each issue should be specifically addressed within the framework of the protocols so that DEB will know how the commodities are to be handled.

Present Consideration

The MBIP has submitted a revised protocol for generating residue data on table grapes fumigated postharvest. MBIP also submitted a protocol for determining levels of MeBr and iBr in/on green cocoa beans fumigated postharvest with MeBr. The protocol for the cocoa beans also provides for roasting the green cocoa beans and processing the roasted beans into chocolate.

Proposed Protocol for Table Grapes

The MBIP (E.A. Liscombe, Ph.D.) has proposed the following protocol. Dr. Liscombe believes that commercial fumigation should be used where possible because commercial fumigations would generally include worst case scenarios with regard to temperature, dosage, and packaging.

The grapes will be imported from Chile where they will be grown in soil which has not been fumigated with MeBr. They will be off-loaded from the freighter and placed on the dock in the usual way. US Government inspectors will remove representative samples of grapes which will serve as controls. The grapes will be covered with a tarp and fumigated.

The temperature of the storage holds on the ship is 34°F. The registrant estimates that the temperature of the grapes would be about 40°F during fumigation.

The grapes will be fumigated as received and will be fumigated at the maximum USDA/APHIS quarantine schedule, namely, 4 lbs. ai/1000 ft³ for 2 hours.

Gas levels will be monitored under the tarp during fumigation to ensure that the following MeBr levels are maintained as required:

48 oz/1000 ft³ after 1/2 hour of exposure, and
38 oz/1000 ft³ after 2 hours of exposure.

After fumigation, the tarp will be removed, and the grapes will be aerated. USDA/APHIS or USFDA inspectors will sample fumigated grapes from various parts of the stacks in the usual way; quadruplicate samples will be collected. Samples will be collected after 2, 4, and 6 hours of aeration.

The samples will be placed in one quart canning jars with screw top lids and stored on dry ice or in a freezer until analysis. If the sampling to analysis time exceeds 18 hours, storage stability studies will be conducted.

Levels of MeBr and inorganic bromide (iBr) will be determined. Each time samples are analyzed, standard curves will be generated from fortification of the check samples.

DEB is referred to Appendices II and III for the methodology to be used in determining MeBr and iBr. [These appendices were apparently inadvertently omitted from the submission.]

DEB's Comments/Conclusions, re: Protocol for Grapes

I. APHIS Procedure for Grape Fumigation

DEB has contacted R. Cole, APHIS, Port Operations. Mr. Cole verified that all imported grapes are fumigated under tarps because it is cheaper and easier. The fumigations are conducted within buildings, rather than on the dock, because of problems on windy days. After fumigation, the grapes undergo forced aeration until the airspace underneath the tarps reaches a safe level. The forced aeration generally lasts for 30 minutes to one hour. The grapes are then transferred to refrigerated trailer trucks for distribution.

According to J. Fons, USDA/APHIS, when it is too cold to fumigate at ambient temperatures, the proper fumigation temperature is maintained with heated air.

II. Fumigation under a Tarpaulin

The MBIP has submitted a "prestudy" which indicated that fumigation underneath tarps resulted in markedly lower residues than chamber fumigations (see memo of 7/14/88, review of C. Deyrup). However, levels of MeBr underneath the tarp were not monitored during fumigation. Because of the "prestudy" results, the registrant's earlier grape protocol used a fumigation chamber, rather than a tarp.

The registrant now proposes to fumigate the grapes under a tarp on the dock. Residue data reflecting the worst case are needed to establish tolerances, but the "prestudy" indicates that the revised protocol may not represent the worst case.

DEB suggests that the registrant determine whether >5% of fumigated grapes would be treated in chambers. If not, DEB could consider restricting the fumigation of grapes to tarp fumigations.

Otherwise, the registrant may need to generate bridging data to determine whether residue levels in grapes fumigated in chambers are similar to levels in grapes fumigated under tarps.

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This time, the MeBr levels should be maintained at the recommended levels during the fumigation.

If chamber fumigation results in higher MeBr levels in grapes, and if chamber fumigation of grapes is commercially significant, then residue data reflecting chamber fumigation would be needed.

III. Analytical Methodology

Although this submission is deficient in that a description of the analytical methodology was not provided, DEB will review those portions of the protocol which were submitted. The registrant will need to submit a description of the analytical methodology.

IV. Issues Cited in DEB's 9/23/88 Review

In meetings with the registrant and in numerous subsequent reviews, many of the issues associated with the grape protocol had been addressed. These include issues such as the need for reflecting commercial practice and documentation to support the description of commercial practice, shorter storage periods or storage stability data, the need for replicate fumigations, the importance of temperature during fumigation and aeration, the practicality of aeration periods, the number of fumigations grapes may be subjected to, etc.

Most of these issues were not addressed in the present submission; some issues, such as the storage periods, have been changed so often in meetings and various submissions, including this one, that DEB can't be sure that any of the issues which had been agreed upon with the registrant still hold sway.

Therefore, in revising the grape protocol, each issue should be specifically addressed within the framework of the protocol so that DEB will know how the grapes will be handled.

DEB will restate each issue from its 9/23/88 review and will discuss the adequacy with which that issue was addressed in the revised protocol submitted in the present amendment. The numbering of each topic follows that of the 9/23/88 review.

1. DEB's Comments/Conclusions, 9/23/88 Review-Preplant Fumigation

The preplant fumigation rate was not specified.

DEB's Comments/Conclusions, re: Issue #1

The preplant data were required by the Methyl Bromide Registration Standard because there are indications that persistent residues of iBr in soil may result in elevated iBr levels in the crop two years after the preplant treatment.

TOX has now concluded that iBr is not of concern (memo of D. Ritter, 4/19/89). Therefore residue data on iBr arising from the preplant use are not needed. This issue is resolved.

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2. DEB's Comments/Conclusions, 9/23/88 Review-Vacuum Chambers

If it is not the registrant's intent to permit the fumigation of grapes in vacuum chambers, the label needs to be revised to delete this use. Otherwise, residue data reflecting vacuum chamber fumigation are required.

DEB's Comments/Conclusions, re: Issue #2

Vacuum fumigation of grapes will not be needed. In a meeting with the registrant (12/15/88), DEB learned that vacuum fumigation was only intended for nuts. This issue is resolved.

3. DEB's Comments/Conclusions, 9/23/88 Review-Fumigation Rate

According to the Plant Protection and Quarantine Manual, grapes may be fumigated at the following rates for 2 hours:

- 1.5 lbs ai/1000 ft³; 80-89°F
- 2.0 lbs ai/1000 ft³; 70-79°F
- 2.5 lbs ai/1000 ft³; 60-69°F
- 3.0 lbs ai/1000 ft³; 50-59°F
- 4.0 lbs ai/1000 ft³; 40-49°F
- 2.0 lbs ai/1000 ft³; ≥70°F; 3.5 hours
- 2.0 lbs ai/1000 ft³; 65-69°F; 4 hours

In order to cover residues in grapes treated for quarantine purposes, it would first be necessary to determine the worst case; the worst case is not immediately obvious because of the variation in the parameters affecting residue levels (dosage rate, exposure time, and temperature). Then residue data representing the worst case would need to be generated.

DEB's Comments/Conclusions, re: Issue #3

The grapes are to be treated at a rate of 4.0 lbs ai/1000 ft³ for 2 hours. The temperature of the grapes will be about 40°F. DEB agrees with the registrant that this rate represents the worst case, if the temperature during fumigation remains between 40-49°F. This issue is resolved, provided that the registrant maintain the fumigation chamber temperature at 40-49°F or show that the temperature of the grapes remains between 40-49°F during the fumigation.

4. DEB's Comments/Conclusions, 9/23/88 Review-Fumigation Temperature

The protocol should specify the fumigation temperature. The label submitted with PP #5F3300 limited fumigation temperatures to ≥50°F. If lower temperatures may occur during commercial operations and if lower temperatures lead to higher residue levels, MBIP will need to demonstrate that the 50°F restriction is feasible and generate the appropriate residue data... The registrant has the option of narrowing the range of fumigation temperatures in a revised label, if such a restriction is commercially practical.

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DEB's Comments/Conclusions, re: Issue #4

Since temperature is the major parameter governing the absorption and desorption of MeBr, DEB has insisted that residue data be generated reflecting the worst case, i.e., the lowest temperature (memos of 7/14/88, 9/23/88, and 11/3/88, and meetings of 11/10/88 and 12/15/88). Residue data reflecting the worst case are needed to establish the tolerance.

According to D. Thomson, USDA/APHIS, most Chilean grapes are fumigated in Philadelphia during the winter. J. Fons, USDA/APHIS informed DEB that the air entering the tarped grapes is heated, if necessary, since the temperature of the grapes can't be below 40°F.

The registrant should conduct the fumigations when the temperature is 50°F or less or demonstrate that the commodity temperature was maintained at 40-49°F.

The issue of the fumigation or commodity temperature is not resolved.

5. DEB's Comments/Conclusions, 9/23/88 Review-Commodity Temperature

If grapes are stored prior to fumigation, residue data should be generated on grapes which have been stored for representative periods at the temperatures used for commercial storage. The temperature at which commodities are stored has been shown to affect residue levels in the commodities. The registrant has the option of specifying the commodity temperature in a revised label; he will need to support the argument that such a restriction is practical.

DEB's Comments/Conclusions, re: Issue #5

In its review of 11/3/88, DEB concluded that the length of storage before fumigation would not appreciably affect MeBr absorption.

This issue is resolved; however, the registrant should also maintain the commodity temperature at ≤50°F during fumigation (see DEB's Comments regarding fumigation temperatures under Issue #4).

6. DEB's Comments/Conclusions, 9/23/88 Review-Aeration Temperature

The aeration temperature should be specified. Again, if different temperatures are used commercially than are observed in the residue study, higher residue levels may result. MBIP has the option of revising the label to specify a range of aeration temperatures, if it can show that such a label restriction is practical. Residue data reflecting the worst case aeration temperature would then be needed.

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DEB's Comments/Conclusions, re: Issue #6

Although DEB cited the aeration temperature as an issue of concern in its memos of 7/14/88, 9/23/88, 11/3/88 and repeated this concern at the meetings of 11/10/88 and 12/15/88, the revised protocol does not take aeration temperature into account.

The aeration temperature should reflect the worst case expected in commercial practice. In estimating the worst case, the registrant should consider the time of year when Chilean grapes enter the US (winter) and the current practice of transferring grapes to refrigerated trucks directly after forced aeration (R. Cole, APHIS, Port Operations). The forced aeration period lasts 30 minutes to one hour.

DEB suggests that the registrant determine whether lengthening the current aeration period before refrigeration is commercially feasible. If it is feasible, then residue data reflecting the worst case ambient aeration temperatures are needed. Since it is possible to heat the airspace under the tarps, the registrant may want to investigate the practicality of specifying a minimum aeration temperature and limiting grape fumigation to tarp fumigation.

If it is not feasible to lengthen the aeration period before refrigeration, the registrant may need to generate residue data reflecting the decline of MeBr residues under cold storage conditions.

The registrant should document his sources in his response. This issue is not resolved.

7. DEB's Comments/Conclusions, 9/23/88 Review-Mode of Aeration

MBIP needs to further describe the aeration (i.e., whether forced or unforced) and should support the position that this type of aeration is used commercially.

The type of aeration used to generate the residue data should be specified on the label.

DEB's Comments/Conclusions, re: Issue #7

According to the revised protocol, the tarps will be removed after fumigation, and the grapes will be permitted to aerate on the dock. DEB was informed that the tarps can't be removed until MeBr residues in the airspace have dropped to an acceptable level after a period of forced aeration. The registrant will need to clarify the mode of aeration in the protocol, which should reflect common commercial practices.

This issue is not resolved.

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8. DEB's Comments/Conclusions, 9/23/88 Review-Packaging

MBIP will need to more fully describe the containers which hold the various lots. Since the size and composition of the containers may affect residue levels in/on the commodities, MBIP will need to support the position that the containers to be used are representative of containers used in commercial operations. If a variety of containers is used commercially, the most commonly used containers should be used to generate the residue data...

Alternatively, the registrant may provide bridging data which indicate which type of container represents the worst case, and residue data reflecting the use of that container could be generated. If it is practical to restrict the types of container used during fumigation, the label may be revised so that fumigation is limited to certain types of container; then residue data reflecting the use of those types of containers would need to be generated.

DEB's Comments/Conclusions, re: Issue #8

No description of the packing was submitted; the grapes "will remain packed the way they arrive..." According to J. Fons, USDA/APHIS, Chilean grapes are often shipped with plastic (PVC) liners.

The residue data will need to reflect this use, as plastic liners have been shown to lead to higher residue levels with some commodities. [At a meeting with the registrant, the USDA reported that after 7 days of aeration, almonds fumigated in plastic liners exhibited MeBr levels almost 8X higher than almonds fumigated in cardboard cartons.]

Issue #8 remains outstanding.

9. DEB's Comments/Conclusions, 9/23/88 Review-Commercial Practices

The residue tests should represent actual commercial fumigation events in all respects, such as MeBr introduction, temperature, humidity, air circulation, packaging, load factor, and aeration and storage conditions. These details should be provided.

DEB's Comments/Conclusions, re: Issue #9

The MBIP plans to fumigate under a tarp and monitor gas levels during the fumigation in a commercial operation. Monitoring the gas levels adequately addresses DEB's concerns regarding air circulation during fumigation.

MBIP should inform DEB whether that the method of MeBr introduction will reflect commercial practice.

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DEB's comments regarding the temperature, storage conditions, aeration conditions, and packaging, are detailed under issues #4, #5, #6, #7, and #8.

The MBIP should address the effect of load factor, which appears to influence residue levels.

According to J. Fons, USDA/APHIS, load factors do not vary much with tarp fumigation, because the framework skeletons underneath the tarps are adjustable. If it is commercially practical to limit grape fumigations to tarp fumigations (see page 8), then load factors should be selected so as to cover 95% of tarp-fumigated grapes.

Otherwise, the MBIP should determine the effect of load factor (as agreed upon at the 12/15/88 meeting) and residue data reflecting the worst commercial case would be needed.

This issue is not resolved.

10. DEB's Comments/Conclusions, 9/23/88 Review-Grape Cultivars

MBIP did not specify which varieties of grapes were to be fumigated. Residue data on common commercial cultivars are needed.

DEB's Comments/Conclusions, re: Issue #10

DEB concludes that residue data from different types of cultivars of grapes would not be needed. According to Dr. H. Moffitt (USDA/ARS), residue levels of MeBr are similar in different apple cultivars bearing closed or open calyxes. Therefore DEB would expect the same situation to pertain in different cultivars of grapes. Issue #10 is resolved.

11. DEB's Comments/Conclusions, 9/23/88 Review-Replicate Fumigations

One fumigation run would not serve as an adequate data base for establishing tolerances for grapes treated according to the proposed use. Residue data from at least 3 fumigation runs are needed.

DEB's Comments/Conclusions, re: Issue #11

This issue was not addressed in the submitted protocol and remains outstanding.

12. DEB's Comments/Conclusions, 9/23/88 Review-Number of Treatments Grapes may Receive

MBIP will need to support the position that grapes receive only one fumigation commercially.

DEB's Comments/Conclusions, re: Issue #12

This issue was not addressed in the submitted protocol and remains outstanding.

If it is possible that >5% of fumigated grapes receive more than one treatment, the protocol may need to reflect this commercial practice. The registrant will need to document the number of fumigations that grapes may receive commercially.

13. DEB's Comments/Conclusions, 9/23/88 Review-Bruised or Stemless Grapes

It has been shown that residue levels in bruised or stemless grapes may be higher for some fumigants. Therefore, the samples should include a representative proportion of bruised and stemless commodities.

DEB's Comments/Conclusions, re: Issue #13

This issue was addressed at the meeting of 11/10/88 and in the amendment of 2/10/89 (see review of 4/25/89, memo of C. Deyrup, DEB #4999).

DEB agreed with the MBIP's 2/10/89 proposal that bruised and stemless fruit would not be excluded from sampling. The grape samples "will be secured from various parts of the stacks by USDA/APHIS or USFDA inspectors in the normal manner."

Issue #13 is resolved.

DEB's Comments/Conclusions, 9/23/88 Review

Issue #14 involved fumigation in trucks and was resolved in DEB's memo of 11/3/88.

15. DEB's Comments/Conclusions, 9/23/88 Review-Sample Selection

The sample selection process should mimic the FDA sample selection process as much as possible.

DEB's Comments/Conclusions, re: Issue #15

The submitted protocol stipulates that sample selection will be carried out by USDA or USFDA inspectors. This issue is resolved.

16. DEB's Comments/Conclusions, 9/23/88 Review-FDA Inspections

DEB reiterates that if tolerances are proposed on the basis of residue levels following a period of aeration, MBIP will need to demonstrate that the aeration period is appropriate (i.e., that the commodity will not be available for sampling by the FDA before the aeration period has elapsed).

DEB's Comments/Conclusions, re: Issue #16

At the meeting of 11/10/88, the registrant said that the USDA will prepare information assessing at what point after fumigation commodities could be sampled by FDA inspectors. This information has not yet been submitted. DEB was informed by APHIS-Port Operations (R. Cole) that grapes are transferred to refrigerated tractor trailers for distribution after a forced aeration period of 30 minutes to one hour.

DEB's Comments/Conclusions under Issue #6 are also pertinent. This issue is not resolved.

17. DEB's Comments/Conclusions, 9/23/88 Review-Storage Stability

A storage stability study is needed for each commodity. The registrant may want to store the samples at -78°C instead of in a freezer.

DEB's Comments/Conclusions, re: Issue # 17

Given the significant decline in MeBr residues in some samples after 0-7 days of freezer storage (up to 85% losses), DEB has been concerned that substantial amounts of the volatile MeBr might be lost during storage. Since tolerances are established to cover residues in commodities in interstate commerce, it is important to ensure that reported residue levels reflect those which an FDA inspector might find.

The original grape protocol (submission of 6/28/88) specified that analyses would be completed within 18 hours of sampling, and the amendment of 9/22/88 revised the storage period to a maximum of 24 hours.

On December 16, 1988, DEB met with representatives of Bolsa, Trical, the DFA, and Great Lakes Chemical Corporation. DEB was informed that the sampling to analysis time would be a maximum of 2-3 hours.

In a subsequent submission (2/10/89, reviewed in DEB's memo of 4/25/89), the MBIP asserted that samples would be analyzed as quickly as possible, often within 45 minutes. Based on that submission and the 12/16/88 meeting, DEB believed that the sampling to analysis time was 2-3 hours, with many samples being analyzed within 45 minutes. DEB concluded that storage stability studies to cover these short periods would not be needed, provided that the revised protocols reflected this change (memos of 4/25/89 and 4/17/89). However, the revised protocol specifies a maximum storage time of 18 hours again

In the 2/10/89 submission, the MBIP asserted that "...the sampling and analysis will be accomplished before the RAC enters into interstate commerce for monitoring by FDA." DEB agrees that under

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these conditions, storage stability data would not be needed; the residue data would adequately cover MeBr levels in grapes undergoing FDA monitoring and subsequently reaching the consumer.

At the meeting of 11/10/88, the MBIP said that the USDA will prepare information assessing at what point after fumigation the commodities could be sampled by the FDA. This information is crucial in determining the need for storage stability data and has not yet been submitted.

In order to determine whether storage stability data are needed, DEB needs to know when commodities could be sampled by the FDA following fumigation and aeration.

The issue regarding the need for storage stability studies to cover the period from sampling to analysis is not resolved.

18. DEB's Comments/Conclusions, 9/23/88 Review-iBr Analyses

Issue #18 involved inorganic bromide analyses (iBr).

DEB's Comments/Conclusions, re: Issue #18

The question of iBr methodologies has been rendered moot. TOX has concluded that residues of iBr are not of concern (memo of D. Ritter, TOX, 4/19/89).

19. DEB's Comments/Conclusions, 9/23/88 Review-Loss of MeBr during Maceration

DEB cautions the registrant that care must be taken to assure that residues of the volatile MeBr are not lost during chopping and compositing, as such a loss could result in grossly underestimating the levels of MeBr. The sample preparation should be described in detail (temperature, time needed for preparation, etc.) and precautions taken to avoid loss of the analyte should be delineated. The registrant will also need to demonstrate that there is no significant loss of MeBr during the sample preparation.

DEB's Comments/Conclusions, re: Issue #19

This issue was not specifically addressed in the submitted protocol. Given the potential for loss of MeBr during chopping, the registrant will need to specifically describe any steps taken to prevent the loss of the volatile analyte during this step.

In the submission of 2/10/89, the MBIP reported that frozen samples are fractured with a mallet, and quickly subdivided into blending jars for analysis, but DEB is not certain that the MBIP still intends to handle grapes in this way.

If the registrant elects not to freeze the samples, he should describe the precautions taken to avoid loss of MeBr.

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This issue is not resolved.

20. DEB's Comments/Conclusions, 9/23/88 Review-Grape Processing

If infested imported grapes are fumigated, the importer may opt to send the grapes to a processor if fumigation has an adverse effect on the shelf life of the grapes. DEB does not consider it likely that these grapes would be dried to yield raisins, but the registrant needs to submit residue data on wet and dry pomace, raisin waste, and juice; details of the processing should be submitted so DEB can determine if the procedure reflects commercial processing.

DEB's Comments/Conclusions, re: Issue #20

The submitted protocol does not include a processing study. Although the protocol is intended to determine residues on "table grapes," DEB does not recognize "table grapes" as a separate category. The same varieties of grapes (e.g., the versatile Thompson grape) may be used for wine, juice, and coolers, as well as for table grapes.

A processing study will therefore be needed. TOX has concluded that iBr is not of concern; if the on-going metabolism studies demonstrate that the volatile MeBr is the only residue of concern, it would not be necessary for the registrant to generate residue data on dry pomace. Although fumigated grapes might be processed to dry pomace, DEB would not expect detectable residues to persist through the drying period required to make dry pomace.

The registrant will need to determine whether residues of MeBr concentrate in the wet pomace and juice from fumigated grapes bearing detectable residues. The potential for concentration exists because MeBr residues are not fleeting. The registrant himself has submitted data indicating that up to 3.9 ppm MeBr may be found in grapes after 18 hours of aeration (PP #5F3300).

For the proposed use on grapes, residue data will not be needed on raisins, and raisin waste. It will be necessary to generate residue data on raisins and raisin waste because raisins are fumigated.

Issue #20 is not resolved.

21. DEB's Comments/Conclusions, 9/23/88 Review

The nature of the residue in plants after postharvest fumigation is not yet adequately understood. If the metabolism studies underway identify other residues of concern, besides MeBr and iBr, additional residue data may be required.

DEB's Comments/Conclusions, re: Issue #21-Residues to be Determined

TOX has concluded that iBr residues arising from the proposed

uses are not of concern (memo of D. Ritter, 4/19/89).

The registrant may analyze for residues of MeBr only, but until the metabolism studies have been completed, this issue remains outstanding.

22. DEB's Comments/Conclusions, 9/23/88 Review

MBIP should heed DEB's comments contained in previous memos and in the Registration Standard regarding the generation of residue data for post harvest use.

DEB's Comments/Conclusions, re: Issue #22

This comment is still valid.

Proposed Protocol for Green Cocoa Beans

Brazilian cocoa beans, which have not been previously treated with MeBr, will be used as received. A total of 128 bags will be tagged and moved to the warehouse; the bags will be on pallets (16 bags per pallet, 8 pallets). A one pint sample will be removed from each of 4 randomly selected bags per pallet (a total of 32 pints). These samples will be composited, and 4 one quart samples will be taken from the original 16 quarts. These samples are to be analyzed for iBr and MeBr. An additional 20 pounds of beans will be removed from each of 4 bags per pallet (another 32 samples or 640 lbs). These beans will receive no postharvest fumigation treatment and will serve as check samples in the determination of the decline of MeBr with time.

The remainder of each pallet will be placed in an 885 ft³ atmospheric fumigation chamber which has been certified by the California Department of Food and Agriculture. The cocoa beans will be treated at a rate of 1.5 lbs ai/1000 ft³ for 24 hours. The temperature of the beans at the time of exposure will be 50°F.

During fumigation, gas concentrations will be sampled from the top center and bottom every 4 hours. The readings from the three locations will be averaged each time samples are taken.

Following fumigation and 24 hours of aeration, a one pint sample of beans will be taken from each of 4 bags per pallet (16 quarts), composited to give 4 one quart samples, and analyzed for MeBr and iBr. The mode of aeration was not specified.

Half the bags (8 bags per pallet) will be removed from the chamber and processed at the Guittard Chocolate Company.

Every 4 days, for a period of 12 days, one pint samples will be taken from each of 4 bags per pallet and composited to give 4 one quart samples for analysis.

The remaining beans will be refumigated as before. After 24 hours

of aeration, one pint samples will be collected as above and analyzed for MeBr and iBr. The beans will then be removed from the chamber and processed.

Processing of Cocoa Beans

Cocoa bean processing begins with the dump hopper. As the bags are dumped, a one pint sample will be taken from each of 4 bags per pallet. These samples will be composited to 4 one quart samples for analysis. After the dump hopper, the beans will pass through the cleaner, the destoner, and the roaster. After removal of the seed coat, the nibs will be ground into chocolate.

The processing study will be integrated into the commercial operation of the plant as follows. The roaster will be running continuously and at full operating temperature. A break in the bean cleaning and destoning operation will be created so that the operator can tell when the treated beans enter the system. While the roaster feed hoppers are emptying the last of the untreated beans into the roaster, the hopper to the cleaning system will be refilled with the fumigated beans. One pint samples will be collected after cleaning (prior to entering the roaster hopper) at a frequency of once per bag and composited as above.

Upon observing the interruption as the last roasted untreated beans exit the roaster, the operator will permit 7 "flush" trays to pass, before collecting samples of treated roasted cocoa beans for analysis. One pint samples will be taken and composited with a frequency of once per bag.

While the treated beans are being roasted, the winnower, which follows the roaster in the operation, will continue to run to use up the preceding untreated beans. After all the test beans have exited the roaster, the winnower will be stopped, and the treated roasted beans will pass into the winnower hopper. The winnower, which separates shells from nibs, will be restarted, and one pint samples will be collected and composited as above, after allowing a few minutes for "flush" nibs to pass. Duplicate samples of nibs will be taken. The nibs will be milled on a laboratory scale. Therefore, the following fractions will be analyzed: beans as dumped; cleaned, destoned beans; roasted beans; nibs; and chocolate.

All samples will be analyzed in quadruplicate. Samples will be immediately placed in glass canning jars with screw top lids and stored on dry ice or in a freezer until analysis. Analysis will be completed within 18 hours of collection or a storage stability study will be undertaken. Each time samples of the treated commodities are analyzed, fortified samples will also be analyzed for comparison with the standard curve.

Pertinent postharvest fumigation data and postharvest analysis data are to be recorded for each sample. DEB was referred to Forms A and B, and Appendices II and III for details; none of these attachments were included with the submission.

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DEB's Comments/Conclusions, re: Green Cocoa Bean Protocol

1. The MBIP submitted an amendment to PP #5F3300 proposing a tolerance of 10 ppm for residues of MeBr on green cocoa beans following postharvest fumigation.

In its review of 6/16/86 (memo of W. Hazel), DEB concluded that, "...the available data indicate that food additive tolerances for MB per se are not necessary following ...fumigation of green cocoa beans...if commercial roasting procedures were used. The petitioner must state whether or not typical commercial roasting methods were used."

The MBIP had described the roasting method as proprietary. Data in DEB's files indicate that commercial roasting temperatures are around 250°F for about one hour (On Food and Cooking, H. McGee, Charles Scribner's Sons, NY, 1984). If the roasting process in MBIP's PP #5F3300 approximated these conditions, a food additive tolerance would not be needed for the postharvest use on green cocoa beans at this time. This situation may change if the ongoing metabolism studies should identify additional residues of concern, besides MeBr.

2. Dr. Hazel also stated that the MBIP must provide evidence that roasted cocoa beans are or are not fumigated (memo of 6/16/86). If >5% of US chocolate is derived from fumigated roasted cocoa beans, then MeBr residue data may be required on the roasted beans, cocoa powder and chocolate processed from fumigated roasted beans.
3. The section of the protocol dealing with the processing of cocoa beans is very well designed and may be adapted to generating residue data on cocoa fractions from fumigated roasted cocoa beans, should that be necessary.
4. Dr. Hazel also pointed out that the residue data needs to reflect the registered use, which corresponds to 1.5 lb ai/1000³ for 12 hours. Unless the MBIP proposes to change the treatment schedule, the residue data should reflect the registered use.
5. The deficiencies cited below were discussed in detail in the grape protocol section of this review. The registrant is referred to the the relevant portions of DEB's Comments/Conclusions, re: Protocol for Grapes.
 - a. DEB's concerns regarding the effect of load factor, fumigation temperature, aeration temperature, and commodity temperatures also pertain to cocoa beans.
 - b. The type of aeration should be specified.
 - c. If, like grapes, cocoa beans are refrigerated after

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fumigation, residue data reflecting this practice may be needed.

- d. The protocol calls for two fumigations of the beans. MBIP should support with documentation its position that cocoa beans are not likely to receive more than two treatments with an interval of 13 days.
 - e. DEB needs to know how long after aeration cocoa beans could be sampled by the FDA.
 - f. DEB recommends that the beans be analyzed within 2-3 hours in order to avoid the need for storage stability data.
 - g. MBIP may proceed with analyses of MeBr, but until the metabolism studies are completed, the issue regarding the nature of the residue remains outstanding. There is no longer a need for residue data on iBr.
6. In addition, DEB wants to know whether one or two decline studies are scheduled in the current protocol. According to the sampling schedule, two decline studies, reflecting fumigation and refumigation, are to be conducted. According to the text, following refumigation, the beans will be removed from the chamber and processed. Which is correct?
7. The MBIP will need to submit Forms A and B so that DEB will know what sort of postharvest fumigation data and postharvest data the registrant plans to submit.

cc: PMSD/ISB, SF, RF, Reg. Std. File-Boodee, Circu, Reviewer-Deyrup
RDI:D. Edwards:5/16/89:R. A. Loranger: 5/17/89
TS-769:CM#2:RM810:X7484:C. Deyrup:cd:5/19/89

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