

# UNIVERSITY OF HAWAII AT MĀNOA

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Subject: Comments in Response to the *QUESTIONS FOR USDA DATA-GATHERING ON USE/USAGE OF METALDEHYDE AND OTHER SLUG/SNAIL CONTROLS*

The following comments are being submitted in response to the email message of April 11, 2006 regarding EPA's risk assessment for the molluscicide metaldehyde. These comments are being submitted on behalf of the Western Integrated Pest Management Center and provide input on the use of metaldehyde and snail and slug control on certain food and ornamental crops in Hawai'i.

Many areas in Hawai'i have the moist conditions which favor development of populations of snails and slugs. Some areas of Hawai'i island (the Big Island) have experienced periods of dramatic increases in snail and slug populations. However, snails and slugs are not only a problem in the wetter windward areas of each island, but can also occur in the drier areas where fields are irrigated. Populations can also decline. The reasons for the population fluctuations are not well understood.

In Hawai'i, there are no winter freezes and snails and slugs feed and are active year-round.

Decollate snails are not present in Hawai'i and are illegal for importation. Biocontrol of snails in Hawai'i is an extremely delicate issue because of the risks presented to the native, endangered snails of the state.

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## QUESTIONS FOR USDA DATA-GATHERING ON USE/USAGE OF METALDEHYDE AND OTHER SLUG/SNAIL CONTROLS

*How serious a problem are snails and slugs in your Region for the following situations:  
In agriculture (by crop, if possible please), specifically, are snails and slugs economic  
pests?*

**Region: Hawai'i**

### **Papaya**

Snails and slugs are found on all islands and are most serious in locations with high rainfall and the presence of abundant plant litter within a papaya field. The giant African snail is a very important pest certain papaya production areas. Snails and slugs are pests of newly planted papayas. Entire plants can be destroyed by the feeding of these pests, but once beyond this stage, damage is usually minimal.

Recently, however, the giant African snail has been found in large numbers in the fruit column in mature trees. The snails cause injury to the leaf stems and scar the tree bark. Four individuals are enough to defoliate and kill a tree. The snails also feed on the fruit, damaging the fruit and make them more susceptible to infections by *Phytophthora palmivora*. Besides physical damage, any effect of contamination of the fresh fruits by the snails themselves is unknown.

*How is metaldehyde (ex. Slugit, Deadline, Corry's Slug and Snail Death) used your in the  
Region?*

*Rates?*

*How often is it used per season or crop cycle?*

Several applications are required when the trees are young.

*What are the intervals between applications?*

The application intervals are highly variable. Treatments are applied when large populations or damage is observed.

*How is it applied?*

Generally, granular metaldehyde is applied as a bait, spread on the ground in the late afternoon to minimize breakdown.

*What are the uses and usage of metaldehyde alternatives in the Region? Examples may  
include:*

*Methiocarb (Mesurol)*

Not labelled for use on papayas.

**Hawaii—Papaya** (*continued*)

*Iron phosphate (ex. Sluggo, Escar-go, Schultz Garden Safe Slug and Snail Bait, Worry Free Slug and Snail)*

Not labelled for use on papayas.

*Coconut oil soap (Concern SlugStop)*

Growers have not used coconut oil soap.

*Copper sulfate slurry or Bordeaux mixture*

Copper sulphate is used for control of various fungal diseases on papaya. It is not used specifically to control snails and slugs on papaya.

*Metallic copper strips or foil (ex. Snail-Barr)*

Growers have not used copper strips. (However, there is a preliminary experiment with copper in a latex paint. A strip of the paint is applied about 5 inches about the soil line.)

*Decollate snails*

Decollate snails are not available for use in Hawai‘i.

*How efficacious are the chemical controls for snails and slugs?*

If used properly metaldehyde can be extremely effective and it usually is. However, when used prior to a heavy rainfall event the effectiveness is reduced considerably. Moreover, products containing metaldehyde may be more effective if watering is withheld for a while after treatment. Growers must decide for themselves what period of time water can safely be withheld without risking injury to the plants.

Copper sprays deter snails from populating the fruit column but does not kill the pest. Copper sulfate is not applied when the trees are young, when snails and slugs do the most damage.

Efficacy of the copper paint against giant African Snails has been disappointing. This tool would not be applicable to seedlings.

*How effective are nonchemical controls in reducing snail/slug damage?*

Mechanical removal (hand picking) is only effective when populations are very small.

*What cultural controls are used if any and how effective are they in the agricultural settings?*

1. Weed free bare ground fallow. Efficacy can be good, but this control may not be practical in Hawai‘i where land values are high.
2. Field sanitation can be quite effective, but are not be sufficient is the micro-environments which are particularly suited to snails and slugs.

**Hawaii—Papaya** (*continued*)

*Are there any use sites for which growers/users view metaldehyde as critical to production or aesthetics? If so, why?*

While not critical to all papaya growers, metaldehyde is critical in certain production areas.

In these critical areas, snail infestations--and disease symptoms—seem to be heavier in perimeter sections of the fields. Infestations and symptoms seem to be lighter toward the center of the fields.

*If applicable, please provide research contacts in your Region who have looked into relative efficacy of slug/snail pesticides (or other aspects of slug/snail control).*

## QUESTIONS FOR USDA DATA-GATHERING ON USE/USAGE OF METALDEHYDE AND OTHER SLUG/SNAIL CONTROLS

*How serious a problem are snails and slugs in your Region for the following situations:  
In agriculture (by crop, if possible please), specifically, are snails and slugs economic  
pests?*

**Region: Hawai'i**

**Dryland Taro** (agricultural production with some information on home gardens)  
Snails and slugs can easily cause damage rates of 10% damage even in dry times of the  
year. Losses can get as high as 20% of the crop.

*How is metaldehyde (ex. Slugit, Deadline, Corry's Slug and Snail Death) used your in the  
Region?*

*Rates?*

To obtain **good** control, metaldehyde is applied at the maximum label rate (40 lbs. per  
acre).

*How often is it used per season or crop cycle?*

Generally twice: first in the early stages, then again in about one in month to kill pests  
that have migrated from adjacent harvested crops. A third treatment may be required one  
month before harvest.

*What are the intervals between applications?*

Intervals depend on the amount of production increments in a general area being treated.  
If a field has been harvested and not re-planted, it would be a good practice to treat prior  
to tilling or rototilling. The next treatment would be at the start of the rainy season,  
monitoring and treating as needed. A third treatment may be required one month before  
harvest.

*How is it applied?*

One method (the easiest) it so apply the pellets using a whirlybird spreader behind a  
tractor. Other methods are also used.

*What are the uses and usage of metaldehyde alternatives in the Region? Examples may  
include:*

*Methiocarb (Mesurol)*

Not labelled for use on this site.

*Iron phosphate (ex. Sluggo, Escar-go, Schultz Garden Safe Slug and Snail Bait, Worry  
Free Slug and Snail)*

Not labelled for use on this site.

**Hawaii—Dryland Taro** (*continued*)

*Coconut oil soap (Concern SlugStop)*

Response indicates growers have not used coconut oil soap and are unable to comment on its efficacy for this use.

*Copper sulfate slurry or Bordeaux mixture*

Copper sulfate is not labelled for use on this site.

*Metallic copper strips or foil (ex. Snail-Barr)*

For **home gardens**, a copper wire is placed on the perimeter of the garden  
Metallic copper strips are not practical for agricultural production.

*Decollate snails*

Decollate snails are not available for use in Hawai'i.

*How efficacious are the chemical controls for snails and slugs?*

Metaldehyde has been found to be very effective if it is applied when slugs are active.  
Some formulations are more effective than others.

*How effective are nonchemical controls in reducing snail/slug damage?*

Beer trapping is used in **home gardens**. It is effective if rain does not dilute the beer and enough beer is maintained in the traps.

*What cultural controls are used if any and how effective are they in the agricultural settings?*

Hand picking and killing are used at night of the first rain. This is not effective for agricultural settings.

*Are there any use sites for which growers/users view metaldehyde as critical to production or aesthetics? If so, why?*

Metaldehyde is the only ingredient labelled for use on dryland taro against snails and slugs. Other tools are not practical for agricultural production and damage ranges from 10 to 20%. Also, the crop can get very smelly from slug and snail excrement in leaf sheathes, where excrement trails can be seen.

*If applicable, please provide research contacts in your Region who have looked into relative efficacy of slug/snail pesticides (or other aspects of slug/snail control).*

**QUESTIONS FOR USDA DATA-GATHERING ON USE/USAGE OF METALDEHYDE AND  
OTHER SLUG/SNAIL CONTROLS**

*How serious a problem are snails and slugs in your Region for the following situations:*

*In agriculture (by crop, if possible please), specifically, are snails and slugs economic pests?*

**Region: Hawai'i**

**Fruit tree nurseries (very young citrus and other fruit trees)**

When there are large infestations, slugs have been known to destroy thousands of dollars of seedlings overnight.

*How is metaldehyde (ex. Slugit, Deadline, Corry's Slug and Snail Death) used in the Region?*

*Rates?*

*How often is it used per season or crop cycle?*

Usually only once at planting. Re-application is seldom necessary.

*What are the intervals between applications?*

*How is it applied?*

Granules are lightly sprinkled around the area of the newly planted seedlings.

*What are the uses and usage of metaldehyde alternatives in the Region? Examples may include:*

*Methiocarb (Mesurol)*

Response indicates growers have not used methiocarb and are unable to comment on its efficacy for this use.

*Iron phosphate (ex. Sluggo, Escar-go, Schultz Garden Safe Slug and Snail Bait, Worry Free Slug and Snail)*

Iron phosphate is not used by these growers because they have not found it to be effective.

*Coconut oil soap (Concern SlugStop)*

Response indicates growers have not used coconut oil soap and are unable to comment on its efficacy for this use.

*Copper sulfate slurry or Bordeaux mixture*

Response indicates growers have not used copper products and are unable to comment on their efficacy for this use.

*Metallic copper strips or foil (ex. Snail-Barr)*

Metallic copper strips are not practical for this application.

**Hawaii—Fruit Tree Nurseries** (*continued*)

*Decollate snails*

Decollate snails are not available for use in Hawai‘i.

*How efficacious are the chemical controls for snails and slugs?*

Metaldehyde has been found to be very effective for use in fruit tree nurseries in Hawai‘i.

Iron phosphate has not been found to be effective

*How effective are nonchemical controls in reducing snail/slug damage?*

Beer trapping has been attempted. This method has been found to be neither practical nor effective

*What cultural controls are used if any and how effective are they in the agricultural settings?*

1. Field sanitation. The nurseries (shadehouses) are kept clean and litter free.
2. Scouting. Field workers are instructed to look for slugs and treat isolated occurrences with table salt.

These are only effective when slug population levels are small. When population explosions occur, these cultural controls are ineffective.

*Are there any use sites for which growers/users view metaldehyde as critical to production or aesthetics? If so, why?*

Metaldehyde is a **very** effective molluscicide. The product works very well for Hawai‘i’s fruit tree nurseries. A little goes a long way. By lightly sprinkling it around nursery areas, when the seedlings are just planted out, the slug problem is significantly controlled.

Without metaldehyde, damage levels can be very high. In some years, infestations of slugs and snails can be very serious. When these occur, thousands of dollars of seedlings can be—and haven been--destroyed overnight.

*If applicable, please provide research contacts in your Region who have looked into relative efficacy of slug/snail pesticides (or other aspects of slug/snail control).*

**QUESTIONS FOR USDA DATA-GATHERING ON USE/USAGE OF METALDEHYDE AND  
OTHER SLUG/SNAIL CONTROLS**

*How serious a problem are snails and slugs in your Region for the following situations:*

*In agriculture (by crop, if possible please), specifically, are snails and slugs economic pests?*

**Region: Hawai'i**

**Orchids** (Dendrobiums, Oncidiums, and others)

Snails and slugs are the most serious pests of orchid growers. They easily decimate the root systems of starter plants. For commercial orchid propagators, this damage makes the plants unsuitable for sale. For larger plants, snails and slugs chew large holes in the pseudobulbs and damage the roots as well. Many of these plants are also unable to be sold. Some plants can survive and be sold later, but the pests must still be eliminated and there are increased costs associated with keeping the plants for another growing season.

In addition to the damage they cause, snails are a concern because shipments of potted orchids to the continental U.S. may be rejected if snails are found by plant quarantine inspectors.

*How is metaldehyde (ex. Slugit, Deadline, Corry's Slug and Snail Death) used in the Region?*

*Rates?*

Application rates vary from operation to operation.

*How often is it used per season or crop cycle?*

There is considerable variation, depending on location of the operation.

*What are the intervals between applications?*

A single application is unlikely to kill all of the snails or slugs. The key is to use repeated applications at regular intervals until all the pests have been killed.

There is considerable variation in the intervals needed to achieve control. For example, on the windward (wetter) areas of the island of O'ahu, metaldehyde may be applied as often as once a month, on the drier sides of O'ahu as little as once or twice a year. On the wetter areas of the island of Hawai'i (the Big Island), snail and slug populations have sometimes, particularly in recent years, exploded dramatically. Orchid nurseries there may perform maintenance applications at intervals of 21 to 28 days. In some instances, control must be achieved by two or three applications at 10-day intervals, followed by treatment at 21-day intervals.

*How is it applied?*

Metaldehyde is applied either as a granular or as a spray or drench.

**Hawaii—Orchids** (*continued*)

*What are the uses and usage of metaldehyde alternatives in the Region? Examples may include:*

*Methiocarb (Mesurol)*

Not many growers use methiocarb. It is a toxic restricted use chemical and most growers do not have a restricted use license.

A nursery that does use methiocarb indicates that it is best used where the foliage is not dense.

*Iron phosphate (ex. Sluggo, Escar-go, Schultz Garden Safe Slug and Snail Bait, Worry Free Slug and Snail)*

Iron phosphate used infrequently and not by many growers. It is only used in a granular form distributed around the perimeter of nurseries.

*Coconut oil soap (Concern SlugStop)*

Growers have not used coconut oil soap.

*Copper sulfate slurry or Bordeaux mixture*

Growers have not used copper products probably because of the potential for phytotoxicity.

*Metallic copper strips or foil (ex. Snail-Barr)*

Metallic copper strips are occasionally used. The strips are wrapped around nursery bench legs.

*Decollate snails*

Decollate snails are not available for use in Hawai‘i.

*How efficacious are the chemical controls for snails and slugs?*

If used properly metaldehyde can be extremely effective and it usually is. However, when used prior to a heavy rainfall event the effectiveness is reduced considerably. Moreover, products containing metaldehyde may be more effective if watering is withheld for a while after treatment. Growers must decide for themselves what period of time water can safely be withheld without risking injury to the plants.

Methiocarb, while being more persistent than metaldehyde, has been found to be less effective than metaldehyde. It is also more hazardous for workers.

Iron phosphate has been found to be less effective than metaldehyde, with some growers reporting that it is only moderately effective at best. It has been found not to have any effect on the orchid snail (*Zonitoides arboreus* [Say]). Additionally, iron phosphate is considerably more expensive than metaldehyde.

**Hawaii—Orchids** (*continued*)

Metallic copper strips are not very effective. They can be fairly effective at first, but as the strips age, they lose their effectiveness. The strips are also expensive and require a great deal of labor to affix to the bench legs.

*How effective are nonchemical controls in reducing snail/slug damage?*

Mechanical removal (hand picking) is only effective when populations are very small.

*What cultural controls are used if any and how effective are they in the agricultural settings?*

1. Field sanitation. The nurseries are kept clean and litter free, eliminating the fallen leaves and other havens for slugs and snails.
2. Disinfesting benches.
3. Scouting. Workers are instructed to look for slugs and snails, to recognize feeding damage and to alert growers or management.

These practices are preventive measures. Without chemical controls, these measures are not sufficient, particularly in locations that are well suited to snails and slugs, to effectively control these pests. Even in areas that are not as highly vulnerable to snails and slugs, metaldehyde treatment may be required once or twice a year.

*Are there any use sites for which growers/users view metaldehyde as critical to production or aesthetics? If so, why?*

Metaldehyde is critical to orchid production.

Snails and slugs are the most serious pests of orchid growers. They easily decimate the root systems of starter plants. For commercial orchid propagators, this damage makes the plants unsuitable for sale. For larger plants, snails and slugs chew large holes in the pseudobulbs and damage the roots as well. Many of these plants are also unable to be sold. Some plants can survive and be sold later, but the pests must still be eliminated and there are increased costs associated with keeping the plants for another growing season.

In addition to the damage they cause, snails are a concern because shipments of potted orchids to the continental U.S. may be rejected if snails are found by plant quarantine inspectors.

*If applicable, please provide research contacts in your Region who have looked into relative efficacy of slug/snail pesticides (or other aspects of slug/snail control).*

**QUESTIONS FOR USDA DATA-GATHERING ON USE/USAGE OF METALDEHYDE AND OTHER SLUG/SNAIL CONTROLS**

*How serious a problem are snails and slugs in your Region for the following situations:*

*In agriculture (by crop, if possible please), specifically, are snails and slugs economic pests?*

**Region: Hawai'i**

**Ornamental Crops: Red Ginger, Foliage plants (Ferns, Aglonema, Ti, Dieffenbachia, etc.), lei flowers (tuberose, carnation, torenia, etc.) and Poinsettia in commercial nurseries and farms.**

Snails and slugs are serious economic pests on all the crops listed. It is estimated that on O'ahu alone these pests cause between 2 to 3 million dollars of damage a year to ornamental crops.

In addition to the damage they cause, snails are a concern because shipments of potted plants to the continental U.S. may be rejected if snails are found by plant quarantine inspectors.

*How is metaldehyde (ex. Slugit, Deadline, Corry's Slug and Snail Death) used your in the Region?*

*Rates?*

Application rates vary from operation to operation.

*How often is it used per season or crop cycle?*

There is considerable variation, depending on location of the operation. On the windward – wetter areas as often as once a month. On the drier sides of O'ahu as little as once or twice a year.

*What are the intervals between applications?*

As short as two weeks and as long as 1 year.

There is considerable variation in the intervals needed to achieve control. For example, on the windward (wetter) areas of the island of O'ahu, metaldehyde may be applied as often as once a month, on the drier sides of O'ahu as little as once or twice a year. On the wetter areas of the island of Hawai'i (the Big Island), snail and slug populations have sometimes, particularly in recent years, exploded dramatically, necessitating shorter application intervals to achieve control.

*How is it applied?*

Metaldehyde is applied either as a granular or as a spray or drench.

## Hawaii—Ornamental Crops (continued)

*What are the uses and usage of metaldehyde alternatives in the Region? Examples may include:*

*Methiocarb (Mesurol)*

Not many growers use methiocarb. It is a toxic restricted use chemical and most growers do not have a restricted use license.

*Iron phosphate (ex. Sluggo, Escar-go, Schultz Garden Safe Slug and Snail Bait, Worry Free Slug and Snail)*

Iron phosphate used infrequently and not by many growers. It is only used in a granular form distributed around the perimeter of nurseries.

*Coconut oil soap (Concern SlugStop)*

Growers have not used coconut oil soap.

*Copper sulfate slurry or Bordeaux mixture*

Growers have not used copper products probably because of the potential for phytotoxicity.

*Metallic copper strips or foil (ex. Snail-Barr)*

Metallic copper strips are occasionally used. The strips are wrapped around nursery bench legs.

*Decollate snails*

Decollate snails are not available for use in Hawai‘i.

*How efficacious are the chemical controls for snails and slugs?*

If used properly metaldehyde can be extremely effective and it usually is. However, when used prior to a heavy rainfall event the effectiveness is reduced considerably. Moreover, products containing metaldehyde may be more effective if watering is withheld for a while after treatment. Growers must decide for themselves what period of time water can safely be withheld without risking injury to the plants.

Iron phosphate has been found to be less effective than metaldehyde, with some growers reporting that it is only moderately effective at best. Additionally, iron phosphate is considerably more expensive than metaldehyde.

Metallic copper strips are not very effective. They can be fairly effective at first, but as the strips age, they lose their effectiveness. The strips are also expensive and require a great deal of labor to affix to the bench legs. It is also expensive to retrofit bench legs.

**Hawaii—Ornamental Crops** *(continued)*

*How effective are nonchemical controls in reducing snail/slug damage?*

Mechanical removal (hand picking) is only effective when populations are very small.

*What cultural controls are used if any and how effective are they in the agricultural settings?*

1. Field sanitation. The nurseries are kept clean and litter free, eliminating the fallen leaves and other havens for slugs and snails.
2. Disinfesting benches.
3. Allowing a fallow period for field crops.

These practices are preventive measures. Without chemical controls, these measures are not sufficient, particularly in locations that are well suited to snails and slugs, to effectively control these pests. Even in areas that are not as highly vulnerable to snails and slugs, metaldehyde treatment may be required once or twice a year.

Allowing a fallow period may be prohibitively expensive in Hawai'i where land values are very high.

*Are there any use sites for which growers/users view metaldehyde as critical to production or aesthetics? If so, why?*

Since the appearance of ornamental crops is the most important factor in their sale, damage by slugs and snails essentially destroys the crops. Damage is kept low now because the use of metaldehyde. Some plants can survive and be sold later, but that entails eliminating the pest and keeping the plant for another growing season. So the lost is of income for the failed crop.

*If applicable, please provide research contacts in your Region who have looked into relative efficacy of slug/snail pesticides (or other aspects of slug/snail control).*

*How serious a problem are snails and slugs in your Region for the following situations:*

*In agriculture (by crop, if possible please), specifically, are snails and slugs economic pests?*

### **Wetland taro in Hawai'i**

The apple snail (*Pomacea canaliculata*) is one of the most important invertebrate pests in wetland taro.

According to the Hawai'i Field Office of the National Agricultural Statistics Service (NASS), Hawai'i taro production is estimated at 4.0 million pounds in 2005, down 19 percent from 2004 and the lowest total since the NASS, USDA, Hawaii Field Office began publishing taro estimates in 1946. The previous record low as 5.0 million pounds set in 2003. Some of the decline can be attributed to weather conditions, but much of the recent decline is the result of persistent pest problems: apple snail and two diseases, taro pocket rot and leaf blight (*Phytophthora colocasiense*).

While no quantitative data has been collected, farmers reported light to extremely heavy apple snail infestations and losses in 2005. Apple snail is considered a major culprit in the crop decline in recent years.

The snail is native to South America and first reported in Hawai'i in 1989.

*How is metaldehyde (ex. Slugit, Deadline, Corry's Slug and Snail Death) used in the Region?*

Metaldehyde is not currently used in wetland taro in Hawai'i. This information is being transmitted at this time because this use will be an IR-4 study this year.

*What are the uses and usage of metaldehyde alternatives in the Region?*

There are no molluscicides registered for use on wetland taro.

There was a 24(c) registration for **copper sulfate** in wetland taro. However, this registration was only in effect in 1994-1996 and was a Restricted-Use. Few, if any, growers used this registration. There is not sufficient data about the efficacy of copper sulfate for apple snail control.

Barriers/repellents such as coconut oil soap (Concern SlugStop) and metallic copper strips or foil (ex. Snail-Barr) are ineffective in the aquatic environment where wetland taro is cultured.

Decollate snails are not present in Hawai'i and are illegal for importation.

*How efficacious are the chemical controls for snails and slugs?*

There are no chemical controls for apple snail in wetland taro.

**Hawaii—Wetland Taro** (*continued*)

*How effective are nonchemical controls in reducing snail/slug damage?*

There are two nonchemical controls: ducks and hand-picking.

Ducks will eat the apple snails, but they will cause damage to the plants because they also eat the taro leaves.

Hand-picking is very expensive.

*What cultural controls are used if any and how effective are they in the agricultural settings?*

Hand-picking the egg cases is done, but this practice is mainly effective on the borders of the paddies where the egg cases can be obviously detected. Egg cases in the interior of the paddies are inconspicuous and it is not a good practice to walk through the paddies frequently because roots will be damaged and leaf blight and other root pathogens could be spread throughout the field.

*Are there any use sites for which growers/users view metaldehyde as critical to production or aesthetics? If so, why?*

*If applicable, please provide research contacts in your Region who have looked into relative efficacy of slug/snail pesticides (or other aspects of slug/snail control).*