

US EPA ARCHIVE DOCUMENT

098301

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Branch File (7)

Date: July 19, 1978

Subject: Risk criteria and RPAR triggers for TEMIK granulars

From: Environmental Safety Section #1

To: ~~See~~ James W. Akerman, Head, Environmental Safety Section #1.

Aldicarb (Temik) granular materials (10G and 15G) have been proposed for new use on pecans, oranges, dry beans, soybeans, and tobacco, and for amended use on sweet potatoes. An initial screen of the potential availability to avian and mammalian species indicated that the basic RPAR risk criteria had been exceeded for all uses except Sweet Potatoes. Further considerations have been made on a crop by crop basis. These considerations were based on information already available, additional environmental chemistry information, and additional information obtained regarding agricultural practices. This memo discusses these risk criteria on a crop by crop basis, followed ^{ing some} by general considerations.

(for all uses)
Current use^{directions} call for irrigation within one week in irrigated areas. ~~for all uses~~ Specific directions for oranges call for prompt^{and thorough} irrigation. There is evidence[&] (Study DD3, L.W. Turner review, 5/18/78) that irrigation markedly reduces the hazards to quail. In various tests 23 out of 30 quail died on ^{treated} dryland plots and 4 out of 30 died on ~~the identical~~ treated irrigated (but otherwise identical) plots. Irrigation was 1 1/2 inches of water applied by sprinkler. Irrigation apparently reduced the effects by the water carrying the chemical out of the granules and into the ground. In shallow in-furrow applications, irrigation also prevented dusting, which brought ~~exposed~~ granules to the surface in a dryland plot.

Current directions for all uses also call for some type of soil incorporation, covering, etc. This has been a concern for some time, as is apparent from the following quotation of an USDA-PRD letter^{to Union Carbide} of March 14, 1969, ^{to Union Carbide} (quoted in the report of study DD3, noted above):

"We have reviewed the simulated field testing with quail as test subjects. Where granules were placed three-four inches below ground surface, test birds apparently suffered no ill effects. Where granules were exposed, as a result of various factors working on shallow placement, hazard apparently became a reality. On the basis of data submitted we require that granules be placed a minimum of two inches below ground surface on the in-furrow treatment. Where dosage or manner of application differs from test conditions additional safety data are required." ~~Such data are also required for irrigated cotton usage";~~

Although the above statement specifies granules be placed a minimum of two inches below the ground surface, several of the crop uses call for nothing more than soil incorporation, which mixes the top several inches of soil. While this spreads the granules evenly to a specific depth, a reduced amount of granules will remain available to birds on the soil surface, with additional granules immediately below the surface. This reviewer feels strongly that the labeled soil incorporation neither meets the intent of the ~~label~~ quotation above nor sufficiently reduces the potential hazard to quail and probably other birds. No additional safety data has been noted that indicates that incorporation alone is sufficient to deal with the hazard. This reviewer also feels that covering ^{with} two inches of soil is sufficient to reduce the hazard ^{to acceptable levels}, even though R. Felthousen's memo on granulated formulations allows only a 10 fold safety factor for covering as compared with incorporation. Using the 10x factor, residues would still exceed the risk criteria for acute effects, but this reviewer does not agree with this factor when cover dirt is 2 inches or more.

Toxicity of aldicarb on an acute basis is given on the attached classification sheet. LD₅₀s in terms of mg/animal are stated here for reference: mouse - 0.008 mg, rat - 0.24 mg, bobwhite - 0.578 mg, mallard - 5.26 mg.

1. Oranges: The 0-hour ^{surface} residues following application as per label directions are 28 mg/ft². Application is to be followed by prompt and thorough irrigation. It is expected that this irrigation will carry the pesticide from the granules into the soil. Even if the pesticide is carried only slightly into the soil, the major effect would be to remove the chemical from the granule, thus rendering the granule much less toxic (or non-toxic if completely removed) to animals that might ingest it. This section's methods for calculating residues of granular formulations do not take the effects of irrigation into account; thus, previous determinations are felt to be inaccurate with respect to risk criteria being exceeded. Additional data is needed to accurately assess the availability of aldicarb following irrigation (specifically, how much pesticide is removed from the granule by a given amount of water), however, this reviewer feels that such irrigation will probably lower residues to a point below that specified by RPAR triggers.

2. Pecans: Specific directions ^{for producing trees} call for application as a 4-6 foot band along the dripline on both sides of the tree, immediately followed by working into the soil or by shanking 2-3 inches into the soil on 12 inch centers. For newly transplanted trees, 1-5 years old, individual trees are to be side dressed followed by working granules into soil to a 2-3 inch depth. The label contains no statement about irrigation beyond the general one (in irrigated areas, irrigate within one week). Following labeled directions, 0-hour residues have been calculated at 36.4 mg/ft^2 for soil incorporation.

"Working into the soil" is a non-specific direction and has been treated as soil incorporation. On this basis, it is felt that the residues do exceed the RPAR risk criteria. Considering that quail seem to utilize orchards to a fair degree (personal communication, Bill LeCroy), these residues are of concern. Shankng of granules would place them below the surface with negligible amounts left on the surface, therefore, use of this method would reduce the availability to a point probably below the RPAR triggers. Other methods of subsurface placement of granules would also suffice to reduce availability, but are not included on the label; nor is any method of subsoil placement labeled for young trees. In addition to shanking, ~~dritting~~ other subsurface application techniques include drilling, opening a furrow and closing it following application, and several others. All of these would be expected to reduce surface availability to below RPAR trigger levels as long as they are two inches

deep. An alternative method to reduce availability would be for prompt and thorough irrigation, as noted in discussion under "oranges".

3. Tobacco: Aldicarb granules are to be applied as a band (12-24 inch) or broadcast followed by soil incorporation. ^{Application is made at time of bed formation.} The 0-hour residues from such application have been calculated as 45.1 mg/fr^2 . ~~At the time of app~~ Although tobacco fields are not considered high use areas for birds and mammals, at the time of application, there can be substantial bird use due to the turning of soil and associated invertebrates. The potential hazard could be based on the ingestion of seeds or seed-like granules versus ingestion of invertebrates. As long as the use directions ~~call for~~ include methods by which dry granules can be left on the surface, there is some concern. However, Furadan 10G granules are currently being used as an insecticide in tobacco, and this section has not been made aware of any avian problems.

As in previous crop considerations, irrigation or actual covering of granules to two inches would be expected to reduce the potential hazard to negligible. Irrigation is not available to a number of tobacco farmers. Covering is not called for in these directions, however, directions for sulfocarb (a liquid) in tobacco call for spraying a band and then forming beds over the treated area. Similar directions of covering for aldicarb granules would provide adequate safety.

This reviewer feels that the present directions are likely to result in some avian mortality, the extent of which cannot be determined. On the basis of Furadan experience, mortality may be insignificant. Even if mortality occurs, however, it would not likely result in population reductions because the duration of the hazard (ie. bird utilization of tobacco fields) would be limited to a short period at the time of soil disruption and application.

4. Dry beans & Soybeans: The application method for both crops is identical. For arthropod control, drill the pesticide 2-3 inches below seed line or 2-3 inches to the side of the seed line (no depth specified). For nematode control, the label calls for 8-12 inch bands with granules worked into the soil or covered. While ~~the~~ the method is the same, the application rate differs. Thus for arthropods, 0-hour residues were calculated as 15.4 mg/ft² for dry beans and 2.9 mg/ft² for soybeans (reconsideration suggests the soybean figure is too low and a more appropriate value would be 11.6 mg/ft²). For nematodes, residues were calculated at 33.8 mg/ft² for dry beans and 27.7 mg/ft² for soybeans.

The above residues were made considering worst case situations. For arthropods, this means drilling 2-3 inches to the side of the seed, which is normally planted about 1-1½ inches deep. By specifying drilling below the seed line an additional 2-3 inches as the only method, the hazard would be reduced to at least acceptable, if not better. For nematodes, worst case residues are based upon soil incorporation, although soil covering is an alternate method, and ^{the latter} would yield acceptable residues. Irrigation would help.

Summary: Based upon label directions, ~~and~~ toxicity, and other available evidence, it is felt that uses on oranges and tobacco can be registered if restricted, without modifications, although some modifications in terms of covering would be desirable for tobacco. Use on oranges is recommended as restricted, because it is felt that only by prompt and thorough irrigation will substantial bird mortality be avoided.

It is further suggested that all remaining, proposed uses are potentially registerable if label modifications are made. One such label modification, ^{for any use} would call for prompt and thorough irrigation. For dry beans and soybeans (arthropods), ~~a~~ elimination of the "side of seed line" application to only below seed line 2-3 inches would ^{very} probably reduce the hazard to acceptable. For pecans and for nematode control in dry beans and soybeans, the soil incorporation, *per se*, must be eliminated; only by covering with soil would the hazard be reduced to acceptable. It is not necessary for both soil covering and irrigation to be specified on the label, although this would be desirable. (If Felthousen's safety factor for covering is determined to be valid, covering alone would be insufficient).

Use of aldicarb should be avoided in Talbot and Dorchester counties of Maryland for the protection of the Delmarva Peninsula Fox Squirrel.

Turner
mental
Section #1

As a general label recommendation (which would probably be contested and cannot be adequately substantiated), it would be desirable to specify use only if application can be followed by prompt and thorough irrigation.

There are other areas that should be addressed with respect to aldicarb and its toxicity. They have been considered but have been determined to not present a risk severe enough to trigger RPA.

1. Turn areas and row ends: Some mortality may occur in these areas. However, if the label directions are followed with respect to incorporation, this would not be expected to be substantial. Of course, covering would be preferable.

2. Toxicity and exposure to mammals has been relegated to a secondary consideration, excepting endangered species.

This is based on the temporary nature of acute toxicity that seems to be the greatest problem for aldicarb.

Application is to be made at planting time (beans, soybeans, tobacco) when fields are essentially barren and contain few wildlife. The mobility of birds allows them to "follow the plow" in search of various invertebrates exposed by such practices. Mammals do not have this same ability, plus there is some question as to whether the food habits of mammals would result in their acting in a similar fashion. Insectivorous mammals would not consume granules, and herbivorous or granivorous mammals would not be likely to respond to such soil disruption to any appreciable extent.

In orchards, resident ~~be~~ granivores would possibly suffer some mortality, but it would be difficult to solicit sympathy for mortality of ^{mammals} animals considered to be vermin, not only by farmers, but by many others. Larger mammals, ^(e.g. squirrels) that are

considered in a more favorable light would not ingest such small particles by choice.

3. The possibility of adverse effects on fish has been considered. The potential exposure of aquatic habitats as a result of a terrestrial application of a granular pesticide has not been fully explored. Drift should be no problem. Runoff could have some effect, however, soil incorporation would reduce this hazard, as would irrigation in an amount below that which would cause runoff. Leaching could be a problem in areas with sandy soils. The sum of such exposure routes does not appear to be sufficient to expect a hazard to aquatic species to the extent that it would exceed RPAR risk criteria. There may, however, be enough chance of exposure to ^{further} support a restricted use classification, although the details have not been worked out.

CLASSIFICATION

rat 0.6 mg/kg ≈ 12 ppm
 mouse 0.4 mg/kg ≈ 2.8 ppm
 mallard LD₅₀ = 4.44 mg/kg #
 mallard LC₅₀ = 594 ppm
 Bobwhite LD₅₀ = 3.4 mg/kg *
 Bobwhite LC₅₀ = 240 ppm #

| PARAMETERS | ORGANISM | GENERAL | RESTRICTED | PERMISSIBLE PRESUMPTIONS |
|------------|---|---|--|--|
| A | MAMMAL | < 1/5 LD ₅₀ | ≥ 1/5 LD ₅₀ to < LD ₅₀ | ≥ LD ₅₀ |
| | mouse LD ₅₀ + mouse LC ₅₀ mallard LD ₅₀ rat LC ₅₀ | < .048 mg < .56 ppm < .0016 mg < 2.4 ppm | .048 - .24 mg .56 - 2.8 ppm .0016 - .008 mg 2.4 - 12 ppm | .24 mg 2.8 ppm .008 mg 12 ppm |
| | AVIAN | < 1/5 LC ₅₀ | ≥ 1/5 LC ₅₀ to < LC ₅₀ | ≥ LC ₅₀ |
| B | Bobwhite LC ₅₀ Bobwhite LD ₅₀ + Mallard LC ₅₀ Mallard LD ₅₀ + | < 48 ppm < .129 mg < 119 ppm < 1.05 mg | 48 - 240 ppm .129 - .646 mg 119 - 594 ppm 1.05 - 5.28 mg | 240 ppm .646 mg 594 ppm 5.28 mg |
| | AQUATIC* | < 1/10 LC ₅₀ | ≥ 1/10 LC ₅₀ to 1/2 LC ₅₀ | > 1/2 LC ₅₀ |
| C | | | | |
| D | The pesticide causes, under conditions of label use, or widespread and commonly recognized practice of use, only minor or no discernible adverse effects on the physiology, growth, population levels, or reproduction rates of non-target organisms, resulting from exposure to the product ingredients, their metabolites or degradation products, whether due to direct application or otherwise resulting from application such as through volatilization, drift, leaching or lateral movement in soil. * based on LD ₅₀ for 10G = 34 mg/kg # supplemental study + converted to mg/animal | | The pesticide causes, under conditions of label use, or widespread and commonly recognized practice of use, discernible adverse effects on the physiology, growth, population levels, or reproduction rates of non-target organisms, resulting from exposure to the product ingredients, their metabolites, or degradation products, whether due to direct application or otherwise resulting from application, such as through volatilization, drift, leaching or lateral movement in soil. | Chronic Toxicity: Can reasonably be anticipated to result in significant local, regional, or national population reductions in non-target organisms, or fatality to members of endangered species. |

Sept 7, 1977

Information from Pat Jones indicates that
average weight of TEMIK granules is 2 mg.