

US EPA ARCHIVE DOCUMENT



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

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

JUL 23 1987

MEMORANDUM

SUBJECT: Comparative Risk Assessment on Ecological Effects
of Azodrin, Supracide, Metasystox R, Furadan 4F,
Capture, Cygon, and Diazinon to Avian Species.

FROM: Harry Craven, Chief
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Harry Craven
7/23/87

TO: Edwin F. Tinsworth, Director
Registration Division

In response to your request for an expedited review (memorandum from E.F.Tinsworth, Director, RD- dated 7/14/87), the EEB has prepared the following comparative risk assessment on the ecological effects of Azodrin, Supracide, Metasystox R, Cygon, Furadan 4F, Capture and Diazinon. As per communication with Mr. Gene Asbury, the assessment only addresses risk to avian species.

If you have any questions concerning this assessment, please contact Dick Felthousen at 557-1392.

DISCUSSION

In order to assess and compare the potential risk to birds from the use of Azodrin, Diazinon, Cygon, Metasystox R, Supracide, Furadan 4F and Capture, acute toxicity data were compared to estimated residues, derived from exposure scenarios developed from label directions, for each chemical. Because there are environmental fate data gaps, a "worse case" scenario was developed for each chemical (i.e., maximum application rates and number of applications, and no interval between applications). The EEB believes that, because documented field effects confirm rather than just predict a hazardous situation, field mortality data must be "weighed" accordingly in any risk comparison analysis. For example, if, based upon toxicity data and exposure profiles, two chemicals appear to pose similar hazards, the use of the chemical with reported incidents of field mortality will be considered to be of greater risk to avian populations.

EXPOSURE SCENARIO

Table 1 shows the range of typical exposure residues expected to occur immediately after application for each chemical. The exposure scenario depicts the "worse case" situation in terms of application rates, number of applications and time intervals between applications.

Table 1: Typical exposure residues expected to occur immediately after application.

Chemical	Application Rate (lbs. ai./A)	Number of Applications	Typical Exposure Residues (ppm)1/
Azodrin	1.0	1 ^{2/}	1.50-125.0
Furadan	1.0	1	1.50-125.0
Diazinon	.5	2	1.50-125.0
Cygon	.5	3	2.25-187.5
Metasystox R	.5	3	2.25-187.5
Supracide	.5	2 ^{2/}	1.50-125.0
Capture	.1	5 ^{2/}	0.75- 62.5

1/ Hoerger and Kenaga (1972) 2/ As specified in memorandum sent to
2/ As specified in memorandum sent to EEB by RD.

ACUTE ORAL TOXICITY DATA (LD50s)

Table 2 compares the toxicity categories for each of the chemicals based upon their acute oral toxicity values (LD50s) to various avian species. Based upon these data, the chemicals are categorized as follows; Azodrin, very highly toxic (0.18-8.1 mg/kg); Furadan 4F, very highly toxic (0.238-5.6 mg/kg); Diazinon, highly to very highly toxic (3.2-40.0 mg/kg), Cygon, highly to very highly toxic (5.4-41.6 mg/kg); Metasystox R, highly toxic (17.0 mg/kg); Supracide, highly toxic (23-33 mg/kg) and Capture, non-toxic to slightly toxic (1,800-2,150 mg/kg). Azodrin and Furadan 4F were the only chemicals whose range of LD50 values all fell within the very highly toxic category. These data show that on an acute oral basis, Azodrin and Capture represent the most and least toxic chemicals, respectively.

DIETARY LC50 TOXICITY DATA (LC50s)

Table 3 compares the toxicity categories for each of the chemicals based upon their dietary toxicity values (LC50s) to various avian species. Based upon these data, the chemicals are categorized as follows; Azodrin, highly to very highly toxic (2.4-60.0 ppm); Furadan, moderately to very highly toxic (21-681 ppm); Diazinon, highly to very highly toxic (47-244 ppm); Metasystox R, slightly to highly toxic (217-2,500 ppm); Supracide, moderately to highly toxic (397-543 ppm); Cygon, slightly to highly toxic (322-1,011 ppm) and Capture, slightly toxic (1,280-4,450 ppm). These data again show that, on a dietary basis, Azodrin and Capture represent the most and least toxic chemicals, respectively.

FIELD MORTALITY DATA

There are reported incidents of avian field mortality from the use of Azodrin, Furadan 4F, Diazinon and Cygon. Study results suggest that Azodrin has the potential to kill hundreds of thousands of birds even when used in accordance with label directions. Furadan has caused the death of thousands of birds. Diazinon accounts for the greatest number of bird kill reports. Only 1 incident has been reported for Cygon. These reports indicate that, based on current use patterns, Azodrin and Furadan are expected to cause broad-spectrum avian mortality to resident and migratory species, Diazinon primarily effects waterfowl species feeding on golf courses and turf farms, and Cygon can cause field mortality to sage grouse from feeding on alfalfa.

Although there have been more reported incidents for Diazinon (mostly because mortality has occurred at highly visible locations such as golf course), both Azodrin and Furadan, because of their greater toxicity, pose higher risks to birds under field conditions. Cygon poses the lowest risk.

Table 2: Comparison of Acute Oral Toxicity Categories for Azodrin, Furadan 4F, Diazinon, Cygon, Metasystox R, Supracide and Capture.^{1/}

<u>CHEMICAL</u>	<u>LD50 (mg/kg)</u>	<u>TOXICITY CATEGORY</u>
Azodrin	0.18- 8.1	Very highly toxic
Furadan 4F	0.23- 5.6	Very highly toxic
Diazinon	3.20-40.0	Highly to very highly toxic
Cygon	5.40-41.6	"
Metasystox R	17.0*	Highly Toxic
Supracide	23- 33	"
Capture	1,800-2,150	Non-toxic to slightly toxic

* Extrapolated value for 100% active ingredient.

^{1/} Category terminology taken from: Insecticides, Brooks, H.L. et al. (1973). Cooperative Extension Service, Kansas State University, Manhattan, Kansas.

Terminology based on the following LD50 values:

<u>LD50 (mg/kg)</u>	<u>Toxicity Category</u>
10	Very Highly Toxic
10-50	Highly Toxic
51-500	Moderately Toxic
501-2000	Slightly Toxic
2000	Practically Non-Toxic

In addition, Azodrin is the only chemical in this group that has been confirmed as causing secondary poisoning in raptor species. (Note: There have been reported cases of secondary poisoning with the granulated Furadan product but not with the 4F product.

Table 3: Comparison of Dietary Toxicity Categories for Azodrin, Furadan 4F, Diazinon, Cygon, Metasystox R, Supracide and Capture.^{1/}

<u>CHEMICAL</u>	<u>LC50 (ppm)</u>	<u>TOXICITY CATEGORY</u>
Azodrin	2.4-60	Highly to very highly toxic
Furadan 4F	21-681	Moderately to very highly toxic
Diazinon	47.0-244	Highly to very highly toxic
Metasystox R	217-2,500*	Slightly to highly toxic
Cygon	322-1,011	Slightly to highly toxic
Supracide	397-543*	Moderately to highly toxic
Capture	1,280-4,450	Slightly toxic

* Extrapolated value for 100% active ingredient.

^{1/} Category terminology taken from: Insecticides: Brooks, H.L. et al. (1973). Cooperative Extension Service, Kansas State University, Manhattan, Kansas.

Terminology based on the following LC50 values:

<u>LC50 (ppm)</u>	<u>Toxicity Category</u>
50	Very highly toxic
50-500	Highly Toxic
501-1000	Moderately Toxic
1001-5000	Slightly Toxic
5000	Practically Non-toxic

TABLE 4. Avian Risk Assessment Comparison for Azodrin, Supracide, Diazinon, Supracide, Diazinon, Capture, Metasystox R, Cygon and Furanan 4F.

	Azodrin	Supracide	Diazinon	Capture	Metasystox R	Cygon	Furanan 4F
Estimated Exposure Typical Residues (ppm)	1.5- 125	1.5- 125	1.5- 125	0.75- 62.5	2.25- 187.5	2.25- 187.5	1.5-125
Acute Mortality:							
LC50 (ppm)	2.4- 60	397- 543*	47- 244	1,280- 4,450	217- 2500*	322- 1,011	21-681
LD50(mg/kg)	0.18-8.1	23-33	3.2-40	1,800-2,150	17*	5.4-41.6	.238-5.6
Field Mortality:							
# of Reports (# of birds)	13 (1,000s)	None	90- 100 (100s)	None	None	1 100	14 (1,000s)
Secondary Hazard Potential	Medium (raptors)	Low	Low	Low	Low	Low	Medium
Persistence (soil 1/2 life)	15 days	14 days	11-60 days	18 wks	30 days	30 days	50 days
Bioaccumulation Potential	Low	Low	Low	Medium	Low	Low	Low
Reproductive Effects Potential	Low	Low	Low	Low	Low	Low	Low
Chronic Effects Potential	Low	Low	Low	Low	Low	Low	Low

* Extrapolated value for 100% technical product.

COMPARATIVE RISK ASSESSMENT

Table 4 provides a summary of the acute toxicity data, field mortality reports, and typical exposure residues for each of the seven chemicals. Because the EEB believes that the potential for chronic effects is low for all of the chemicals, this comparative risk assessment will only address acute effects.

- AZODRIN: Acute toxicity data show that Azodrin is the most toxic of the seven chemicals to birds. Typical exposure residues are expected to be 52X the lowest reported LC50 value (e.g., 125/2.4). These data, coupled with documented incidents of field mortality, which show that Azodrin has the potential to kill hundreds of thousands of birds, clearly demonstrate that Azodrin poses the highest risk to avian species.
- FURADAN 4F: Acute toxicity data show that Furadan 4F is second to Azodrin in toxicity to birds. Typical exposure residues are expected to be 6X the lowest reported LC50 value (e.g., 125/21). Therefore, the data show that Furadan 4F poses less risk than Azodrin but greater risk than Diazinon to avian species.
- DIAZINON: Acute toxicity data show that Diazinon is the third most toxic of the 7 chemicals to birds. The highest typical exposure residues are expected to be 2.6X the lowest reported LC50 value (e.g., 125/47). These data, coupled with the numerous documented incidents of field mortality, show that Diazinon is very hazardous to avian species and likely to cause field mortality.
- CYGON: Acute toxicity data show that Cygon is similar in toxicity to Metasystox R and Supracide. The highest typical exposure residues are expected to be 0.6X the lowest reported LC50 value (e.g. 187.5/322). This is somewhat lower than the residue/LC50 ratio for Metasystox R (0.9X) and indicates that Cygon is less hazardous than Metasystox R. However, because there is documentation that Cygon causes field mortality in sage grouse, the EEB believes it poses a higher risk than Metasystox R to avian species.
- METASYSTOX R: Acute toxicity data show that Metasystox R is similar in toxicity to Supracide. The highest typical exposure residues are expected to be 0.9X the lowest reported LC50 value (e.g., 187.5/217). This compares to residue/LC50 ratios of 0.3X and 0.6X for Supracide and Cygon, respectively. Because there are no field incident reports for Metasystox R, EEB believes it poses less risk than Cygon to avian species.
- SUPRACIDE: Acute toxicity data show that Supracide is considered to be moderately to highly toxic to avian species. The highest typical exposure residues are expected to be 0.3X the lowest reported LC50 value (e.g., 125/397). This compares to 0.9X for Metasystox and 0.6X for Cygon and indicates that Supracide poses less risk to avian species than either of these chemicals.

CAPTURE:

Acute toxicity data show that Capture is slightly toxic to avian species. The highest typical exposure residues are expected to be only 0.05X the lowest reported LC50 value (e.g., 62.5/1280). These data show that Capture poses the lowest risk, of the seven chemicals, to avian species.

SUMMARY

Based upon the above comparative analysis, the EEB believes that, of the 7 chemicals, Azodrin poses the greatest risk to avian species. Capture poses the lowest risk. The EEB believes that the use of Capture, Metasystox R and Supracide will pose very low risks whereas the use of Azodrin, Furadan 4F, Diazinon and Cygon will likely result in some field mortality to certain avian species. The EEB concludes that a risk profile for the seven chemicals, in descending order of risk, is as follows:

<u>Chemical</u>	<u>Risk Profile Rank</u>
Azodrin-----	1
Furadan 4F-----	2
Diazinon-----	3
Cygon-----	4
Metasystox R-----	5
Supracide-----	6
Capture-----	7

RECOMMENDATIONS

The EEB believes, based on toxicity data, field mortality reports, and typical exposure levels, that the use of Azodrin, Furadan 4F, Diazinon and Cygon will cause avian mortality to occur even if these chemicals are used in accordance with label directions.

Therefore, the EEB recommends that only Metasystox R, Supracide and/or Capture be considered for use to control Bank's grass mites on corn in Texas under the Section 18 Specific Exemption. These chemicals will pose the lowest risk of hazard to avian species when used in accordance with label directions.