File

TURF

12-20-96
12-20-96

DP Barcode : D231145
PC Code No : 128810
EEB Out : DEC 20 1996

To: Cynthia Giles-Parker/John Bazuin
Product Manager 22
Registration Division (7505C)

From: Anthony F. Maciorowski, Chief
Ecological Effects Branch/EFED (7507C)

Attached, please find the EEB review of...

Reg./File # : 10182-UNI ICIA5504 50WG
Chemical Name : Azoxystrobin
Type Product : Fungicide
Product Name :
Company Name : Zeneca Ag Products
Purpose : New Chemical - proposed use on turf

Action Code : 115 Date Due : 03/01/96
Reviewer : William Erickson Date In : 11/05/96

EEB Guideline/MRID Summary Table: The review in this package contains an evaluation of the following:

Gdln No.	MRID No.	Cat.	Gdln No.	MRID No.	Cat.	Gdln No.	MRID No.	Cat.
71-1(a)			72-2(a)			72-7(a)		
71-1(b)			72-2(b)			72-7(b)		
71-2(a)			72-3(a)			122-1(a)		
71-2(b)			72-3(b)			122-1(b)		
71-3			72-3(c)			122-2		
71-4(a)			72-3(d)			123-1(a)		
71-4(b)			72-3(e)			123-1(b)		
71-5(a)			72-3(f)			123-2		
71-5(b)			72-4(a)			124-1		
72-1(a)			72-4(b)			124-2		
72-1(b)			72-5			141-1		
72-1(c)			72-6			141-2		
72-1(d)						141-5		

Y=Acceptable (Study satisfied Guideline)/Concur
P=Partial (Study partially fulfilled Guideline but additional information is needed
S=Supplemental (Study provided useful information but Guideline was not satisfied)
N=Unacceptable (Study was rejected)/Nonconcur

(1)

DP BARCODE: D231145

CASE: 005533 DATA PACKAGE RECORD DATE: 11/01/96
SUBMISSION: S513013 BEAN SHEET Page 1 of 1

* * * CASE/SUBMISSION INFORMATION * * *

CASE TYPE: REGISTRATION ACTION: 115 NC-NON-FOOD/FEED USE
RANKING : 10 POINTS ()
CHEMICALS: 128810 Azoxystrobin (BSI proposed name) (CAS Reg. No. 131 50.0000%

ID#: 010182-UNI ICIA5504 50WG
COMPANY: 010182 ZENECA AG PRODUCTS
PRODUCT MANAGER: 22 CYNTHIA GILES-PARKER 703-305-5540 ROOM: CM2 229
PM TEAM REVIEWER: JOHN BAZUIN 703-305-7381 ROOM: CM2 261
RECEIVED DATE: 10/10/96 DUE OUT DATE: 04/18/97

* * * DATA PACKAGE INFORMATION * * *

DP BARCODE: 231145 EXPEDITE: N DATE SENT: 11/01/96 DATE RET.: / /
CHEMICAL: 128810 Azoxystrobin (BSI proposed name) (CAS Reg. No. 131860-33-8)
DP TYPE: 999
CSF: N LABEL: N

ASSIGNED TO	DATE IN	DATE OUT	
DIV : EFED	11/01/96	/ /	ADMIN DUE DATE: 03/01/97 (12/20/96 ?)
BRAN: EEB	11/5/96	12/20/96	NEGOT DATE: / /
SECT: IO	11/5/96	12/19/96	PROJ DATE: / /
REVR : Erickson	11/5/96	12/18/96	
CONTR:	/ /	/ /	

* * * DATA REVIEW INSTRUCTIONS * * *

Azoxystrobin Reduced Risk Pesticide

Under a recent agreement with Zeneca, the registrant, all food uses have been removed from the label of this product, leaving only golf course turf and comercial turf, farm turf as the use sites. These turf uses have a priority of "1". Please note that Azoxystrobin has three pending products at this point, but a present only the 10182-UNI product (the subject of this BEAN) has had this label modification made. The -URL and -URA product labels have not been so modified.

JB

* * * DATA PACKAGE EVALUATION * * *

No evaluation is written for this data package

* * * ADDITIONAL DATA PACKAGES FOR THIS SUBMISSION * * *

DP BC	BRANCH/SECTION	DATE OUT	DUE BACK	INS	CSF	LABEL
231142	IO/IO	11/01/96	03/01/97	Y	N	N
231144	EFGB/IO	11/01/96	03/01/97	Y	N	N

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AZOXYSTROBIN
NEW CHEMICAL REVIEW

EXECUTIVE SUMMARY

Proposed Use:

Azoxystrobin is a broad-spectrum fungicide for control of turf diseases on commercial sod farms and golf courses. The wettable granules are diluted with water for ground-spray applications at rates ranging from 0.25 to 0.55 lb ai/acre. The application interval is 14 to 28 days for most diseases. No more than 5.0 lb ai/acre can be applied per year.

Toxicity Summary:

The available acute toxicity data on the TGAI indicate that azoxystrobin is practically nontoxic to birds (LD50 >2000 mg/kg; LC50s >5200 ppm), mammals (LD50 >5000 mg/kg), and bees (LD50 = >200 μg/bee) but is highly toxic to freshwater fish (LC50 = 470 ppb), freshwater invertebrates (EC50 = 259 ppb), and estuarine/marine fish (LC50 = 670 ppb) and very highly toxic to estuarine/marine invertebrates (EC50 = 56 ppb). Plant data established that the most sensitive terrestrial species was carrot (EC25 = 0.59 lb ai/acre) and the most sensitive aquatic species was an algae (EC50 = 0.1 ppm).

The available acute toxicity data on degradates indicate that R234886 is practically nontoxic to rainbow trout (LC50 >150 ppm) and daphnids (EC50 >190 ppm). Degradates R402173 and 401553 may be slightly toxic to daphnids (EC50s >50 ppm, the only concentration tested).

Chronic studies with the TGAI established NOEC and LOEC values of 300 and 1500 ppm for small mammals (reduced pup weights), 1200 and 3000 ppm for mallards (egg production), and 44 and 84 ppb for freshwater invertebrates (young produced). An MATC of 168 ppb was established for freshwater fish, based on adverse effects on larvae length.

The only outstanding data requirement is an avian reproduction test with the bobwhite quail (71-4a).

Risk Assessment Summary:

Birds: No acute risk LOCs are exceeded when the maximum number of applications and maximum EECs are assumed. Based on reproduction toxicity values established for the mallard, the chronic risk LOC is not exceeded. However, because valid bobwhite quail reproduction data have not been submitted, the chronic risk assessment cannot be completed.

Mammals: No acute risk LOCs are exceeded when the maximum number of applications and maximum EECs are assumed. The chronic risk LOC is exceeded for small herbivores (RQ = 1.74) when the maximum number of applications and maximum EEC from the initial application are assumed. The chronic LOC is not exceeded for small herbivores if the mean EEC is assumed, nor is it exceeded for insectivores based on either the maximum or mean EEC. Because turf on sod farms and golf courses is mowed and watered regularly, short grass EECs estimated from EFED's "FATE" program and the RQs based on them are likely to be lower than predicted.

Fish and Aquatic Invertebrates: Based on aquatic EECs derived from GENEEC, the acute high risk LOC is exceeded only for estuarine/marine invertebrates for multiple applications (RQ = 1.16). The restricted use and endangered species LOCs are exceeded for freshwater fish, freshwater invertebrates, and estuarine/marine fish for multiple applications (RQs = 0.10 to 0.25) and for estuarine/marine invertebrates for both single (RQ = 0.14) and multiple applications. However, because GENEEC is overly conservative for turf (a non-agricultural scenario) and a refined model is not available, EFED believes EECs derived from GENEEC may be overestimated 6-fold for azoxystrobin. Therefore, no acute or chronic LOCs are presumed to be exceeded.

Plants: Terrestrial and aquatic plant testing are not required for the proposed uses of azoxystrobin, but data were submitted and used for risk assessments. The endangered species LOC is exceeded for terrestrial plants inhabiting semi-aquatic areas (RQ = 2.56). However, because runoff from turf is likely to be considerably less than predicted from an agricultural crop scenario, the LOC is not likely to be exceeded.

USE PROFILE

Azoxystrobin is a broad-spectrum fungicide proposed for control of major diseases of turf. The proposed formulation is a 50% ai wettable granule intended for dilution with water for spray application by ground. It will be labeled for control of anthracnose, brown patch, Pythium blight, melting out, leaf spot, necrotic ring spot, red thread, summer patch, gray snow mold (Typhula blight), pink snow mold, gray leaf spot, spring dead spot, zoysia patch, Fusarium patch, and take-all patch on golf courses and commercial turf farms. It is recommended as a stand-alone product to be used in alternating spray programs with other fungicides. Tank mixing with other fungicides is recommended when diseases not controlled by azoxystrobin are present.

The application rate for turf is 0.2 to 0.4 oz. product per 1000 ft^2 (0.25 to 0.55 lb ai/acre), with no more than 10 lb product/acre/year (5.0 lb ai/acre/year). Applications should be alternated with other fungicides, with no more than two sequential applications of azoxystrobin for Pythium spp. control and no more than three sequential applications for control of all other diseases. Product should be applied when conditions are favorable for disease development. The application interval is 14 to 28 days for most diseases but is 10 to 14 days for Pythium blight and Pythium root rot.

ECOLOGICAL TOXICITY DATA

Toxicity to Terrestrial Animals

Birds, Acute and Subacute

An acute oral toxicity study using the technical grade of the active ingredient (TGAI) is required to establish the toxicity of azoxystrobin to birds. The preferred test species is either mallard duck (a waterfowl) or bobwhite quail (an upland gamebird). Results of this test are tabulated below.

Avian Acute Oral Toxicity

Species	% ai	LD50 (mg/kg)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	96.2	>2000[1]	practically nontoxic	436781-08 (Hakin et al. 1992)	core
Mallard duck *(Anas platyrhynchos)*	96.2	>250[2]	not determined	436781-09 (Hakin et al. 1992)	supplemental[3]

[1] no mortality

[2] one mortality occurred at 2000 mg/kg

[3] because several test birds vomited food containing the test substance, an LD50 could not be determined

Because the core study established an LD50 >2000 mg/kg, azoxystrobin is considered practically nontoxic to avian species on an acute oral basis. The guideline (71-1) is fulfilled (MRID 436781-08).

Two subacute dietary studies using the TGAI are required to establish the toxicity of a pesticide to birds. The preferred test species are mallard duck and bobwhite quail. Results of these tests are tabulated below.

Avian Subacute Dietary Toxicity

Species	% ai	LC50 (ppm)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Northern bobwhite quail *(Colinus virginianus)*	96.2	>5200[1]	practically nontoxic	436781-10 (Hakin et al., 1992)	core
Mallard duck *(Anas platyrhynchos)*	96.2	>5200[2]	practically nontoxic	436781-11 (Hakin et al., 1992)	core

[1] one mortality occurred at 650 ppm but was not considered to be treatment-related
[2] no mortality

Because the LC50 values exceed 5000 ppm, azoxystrobin is considered practically nontoxic to avian species on a subacute dietary basis. The guideline (71-2) is fulfilled (MRIDs 436781-10, 436781-11).

Birds, Chronic

Avian reproduction studies using the TGAI are required for azoxystrobin because the following conditions are met: (1) birds may be subject to repeated or continuous exposure to azoxystrobin, especially preceding or during the breeding season, because multiple applications are allowed; and (2) azoxystrobin is stable in the environment (soil aerobic metabolism half-life = 164 days) to the extent that potentially toxic amounts may persist in animal feed. The preferred test species are mallard duck and bobwhite quail. Results of these tests are tabulated below.

Avian Reproduction Findings

Species	% ai	NOEC/LOEC (ppm)	Affected Endpoints	MRID No. (Author/Year)	Study Classification
Mallard duck *(Anas platyrhynchos)*	96.2	NOEC = 1200 LOEC = 3000	number of eggs laid	436781-13 (Cameron et al. 1994)	core
Northern bobwhite quail *(Colinus virginianus)*	96.2	not determined	not determined	436781-12 (Cameron et al. 1994)	invalid[1]

[1] excessively high mortality occurred in control pens

The results indicate an NOEC of 1200 ppm and an LOEC of 3000 ppm, based on a significant reduction in the number of eggs laid by the mallard duck. Valid data have not been submitted for the bobwhite quail. The guideline (71-4) is fulfilled for the mallard (MRID 436781-13) but not for the bobwhite quail.

Mammals, Acute and Chronic

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern and pertinent environmental fate characteristics. In most cases, laboratory rat or mouse toxicity values obtained from the Agency's Health Effects Division (HED) substitute for wild mammal testing. The available data for azoxystrobin are tabulated below.

Mammalian Acute and Chronic Toxicity

Species	% ai	Toxicity Results	Toxicity Category	MRID No.
Laboratory rat *(Rattus norvegicus)*	95.2	LD50 >5000 mg/kg	practically nontoxic	436781-22
		NOEC = 300 ppm[1] LOEC = 1500 ppm	n/a	436781-44
Rabbit		NOEC = 16,500 ppm[2] LOEC = >16,500 ppm	n/a	440587-01

[1] based on decreased pup body weights of first and second generation pups, reduced food consumption and increased adjusted liver weights in females, histopathologically observed cholangitis, and increased weanling liver weights for both generations

[2] no fetal toxicity occurred at 16,500 ppm, the highest dose tested

The data indicate that azoxystrobin is practically nontoxic to small mammals on an acute oral basis. Chronic reproductive and systemic toxicity was observed at a test level of 1500 ppm in a two-generation reproductive toxicity study with laboratory rats. No fetal toxicity occurred in rabbits tested up to 16,500 ppm.

Insects

A honey bee acute contact study is not required for turf use, but studies with the TGAI and formulated product were submitted and reviewed. Results of these tests are tabulated below.

Nontarget Insect Acute Contact Toxicity

Species	% ai	LD50 (µg/bee)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Honey bee *(Apis mellifera)*	96.2	>200	practically nontoxic	436781-66 (Gough et al. 1993)	core
Honey bee *(Apis mellifera)*	51.6	>200	practically nontoxic	436781-67 (Gough et al. 1994)	core

The results indicate that azoxystrobin is practically nontoxic to bees on an acute contact basis.

Other invertebrates

The studies summarized below were not required but were submitted and reviewed.

Toxicity to earthworms, beetles, and flies

Species	% ai	Toxicity	MRID No. (Author/Year)	Study Classification
Earthworm *(Eisenia foetida)*	96.2	LC50 = 278 mg ai/kg	436781-68 (Fleming et al. 1993)	supplemental[1]
Hovertly *(Episyrphus balteatus)*	25	no. larvae produced was significantly adversely affected at a test concentration of 0.22 lb ai/acre. the only concentration tested	436781-70 (Coulson et al. 1994)	supplemental[1]
Carabid beetle *(Poecilus cupreus)*	23.7	no adverse affects at test concentration of 0.22 lb ai/acre. the only concentration tested	436781-69 (Yearsdon and Farrelly 1994)	supplemental[1]

[1] not a guideline requirement

The studies are not guideline requirements but provide supplemental information on the toxicity of azoxystrobin to earthworms, flies, and beetles.

Toxicity to Freshwater Aquatic Animals

Freshwater Fish, Acute

Two freshwater fish toxicity studies using the TGAI are required to establish the toxicity of azoxystrobin to fish. The preferred test species are rainbow trout (a coldwater fish) and bluegill sunfish (a warmwater fish). Results of these tests are tabulated below.

Freshwater Fish Acute Toxicity

Species	% ai	Test Conditions	96-h LC50 (ppm)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Rainbow trout *(Oncorhynchus mykiss)*	96.2	flow-through (measured)	0.47	highly toxic	436781-15 (Craig et al. 1992)	core
Bluegill sunfish *(Lepomis macrochirus)*	96.2	flow-through (measured)	1.1	moderately toxic	436781-14 (Sankey et al. 1992)	core

Because the LC50 values are in the range of 0.1 to 10 ppm, azoxystrobin is considered highly to moderately toxic to freshwater fish on an acute basis. The guideline (72-1) is fulfilled (MRIDs 436781-14, 436781-15).

Freshwater Fish, Chronic

A freshwater fish early life-stage test using the TGAI is required for azoxystrobin because the end-use product may be transported to water from the intended use site (turf), and the following conditions are met: (1) because azoxystrobin is intended for multiple applications on sod farms and golf courses, its presence in water is likely to be continuous or recurrent regardless of toxicity; and (2) the rainbow trout acute LC50 (0.47 ppm) is less than 1 mg/l. The preferred test species is the rainbow trout. Results of this testing are tabulated below.

Freshwater Fish Early Life-Stage Toxicity Under Flow-through Conditions

Species	% ai	Test Conditions	NOEC/LOEC (ppb)	MATC[1] (ppb)	Endpoints Affected	MRID No. (Author/Year)	Study Classification
Fathead minnow *(Pimephales promelas)*	96.2	flow-through (measured)	NOEC = 147 LOEC = 193	168	length	436781-20 (Rhodes et al. 1994)	core

[1] defined as the geometric mean of the NOEC and LOEC

The results indicate an MATC of 168 ppb, based on an NOEC of 147 ppb and an LOEC of 193 ppb for significant adverse effects on length of newly hatched fathead minnows. The guideline (72-4a) is fulfilled (MRID 436781-20).

A freshwater fish life-cycle test using the TGAI is triggered for azoxystrobin, because the 56-day-average EEC (49 ppb) derived from GENEEC is greater than 0.1 of the NOEC (0.1 x 147 ppb = 14.7 ppb) in the fish early life-stage test. However, because GENEEC is presumed to overestimate EECs 6-fold for azoxystrobin use on turf (see aquatic exposure section), the 56-day-average EEC has been adjusted to 8 ppb. Therefore, this study (72-5) is not required to support turf use (i.e., 8 ppb < 14.7 ppb).

Freshwater Invertebrates, Acute

A freshwater aquatic invertebrate toxicity test using the TGAI ingredient is required to establish the toxicity of azoxystrobin to invertebrates. The preferred test species is *Daphnia magna*. Results of this test are tabulated below.

Freshwater Invertebrate Acute Toxicity

Species	% ai	Test Conditions	48-h EC50 (ppb)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Waterflea *(Daphnia magna)*	96.2	static (measured)	259	highly toxic	436781-16 (Rapley et al. 1994)	core

Because the EC50 is between 0.1 to 1 ppm, azoxystrobin is considered highly toxic to aquatic invertebrates on an acute basis. The guideline (72-2) is fulfilled (MRID 436781-16).

Freshwater Invertebrate, Chronic

A freshwater aquatic invertebrate life-cycle test using the TGAI is required for azoxystrobin, because the end-use product is expected to be transported to water from the intended use site and the following conditions are met: (1) azoxystrobin is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity; (2) the daphnid acute EC50 (0.259 ppm) is less than 1 mg/l; and (3) the peak aquatic EEC (65 ppb) is greater than 0.01 of the acute EC50 (0.01 x 259 ppb = 2.6 ppb). The preferred test species is *Daphnia magna*. Results of testing with azoxystrobin are tabulated below.

Freshwater Aquatic Invertebrate Life-Cycle Toxicity

Species	% ai	Test Conditions	21-day NOEC/LOEC (ppb)	MATC[1] (ppb)	Endpoint Affected	MRID No. (Author/Year)	Study Classification
Waterflea *(Daphnia magna)*	96.2	static renewal (measured)	NOEC = 44 LOEC = 84	61	no. young produced	436781-21 (Rapley et al. 1994)	core

[1] defined as the geometric mean of the NOEC and LOEC

The results indicate an NOEC of 44 ppb and an LOEC of 84 ppb, based on the number of young produced by daphnids exposed to azoxystrobin. The guideline (72-4b) is fulfilled (MRID 436781-21).

Freshwater Organisms, Acute (Degradates)

Degradate testing was not required to support registration of azoxystrobin on turf. However, acute toxicity studies with freshwater organisms were submitted and reviewed. Results of these tests are tabulated below.

Freshwater Organism Acute Toxicity (Degradates)

Species	Degradate (% ai)	EC50 or LC50 (ppm)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Rainbow trout *(Oncorhynchus mykiss)*	R234886 (98)	>150	practically nontoxic	441588-03	core
Waterflea *(Daphnia magna)*	R234886 (98)	>190	practically nontoxic	441588-04	core
Waterflea	R401553 (99)	>50	slightly toxic[1]	441588-01	supplemental[2]
Waterflea	R402173 (98)	>50	slightly toxic[1]	441588-02	supplemental[2]

[1] the toxicity of degradates R401553 and R402173 exceeded 50 ppm (the only dose tested) but was not shown to exceed 100 ppm; therefore, these two degradates are considered slightly toxic

[2] the study did not meet all procedural requirements and recommendations for guideline testing

Based on these results, the degradates tested are considered to be slightly to practically nontoxic to freshwater organisms.

Toxicity to Estuarine and Marine Animals

Estuarine and Marine Fish, Acute

Acute toxicity testing with estuarine/marine fish using the TGAI is required for azoxystrobin because the end-use product is expected to reach this environment because of its use in coastal counties. The preferred test species is sheepshead minnow. Results of this testing is tabulated below.

Estuarine/Marine Fish Acute Toxicity

Species	% ai	Test Conditions	96-h LC50 (ppm)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Sheepshead minnow *(Cyprinodon variegatus)*	96.2	flow-through (measured)	0.67	highly toxic	436781-17 (Sankey et al. 1992)	core

Because the LC50 is between 0.1 to 1 ppm, azoxystrobin is considered highly toxic to estuarine/marine fish on an acute basis. The guideline (72-3a) is fulfilled (MRID 436781-17).

Estuarine and Marine Invertebrates, Acute

Acute toxicity testing with estuarine/marine invertebrates using the TGAI is required for azoxystrobin because the end-use product is expected to be transported to the marine/estuarine environment because of its use in coastal counties. The preferred test species are mysid shrimp and eastern oyster. Results of these tests are tabulated below.

Estuarine/Marine Invertebrate Acute Toxicity

Species	% ai.	Test Conditions	96-h EC50/ LC50 (ppb)	Toxicity Category	MRID No. (Author/Year)	Study Classification
Mysid *(Americamysis bahia)*	96.2	static (measured)	56	very highly toxic	436781-18 (Kent et al. 1993)	core
Pacific oyster (larvae) *(Crassostrea gigas)*	96.2	static (nominal)	1300	moderately toxic	436781-19 (Kent et al. 1993)	core

Because the EC50 and LC50 values are between <0.1 and 10 ppm, azoxystrobin is considered very highly toxic to moderately toxic to estuarine/marine invertebrates on an acute basis. The guideline (72-3b and 72-3c) is fulfilled (MRID 436781-18, 436781-19).

Toxicity to Plants

Terrestrial

Currently, terrestrial plant testing is not required for pesticides other than herbicides except on a case-by-case basis (e.g., labeling bears phytotoxicity warnings incident data or literature that demonstrate phytotoxicity). Data are not required for azoxystrobin, but Tier I data for the TEP were submitted and reviewed. Results of the Tier 1 testing, which compares the response of plants treated at the maximum application rate to that of untreated plants, are tabulated below.

Nontarget Terrestrial Plant Seedling Emergence Toxicity (Tier I)[1]

Species	Endpoint Affected[2]	% Inhibition	MRID No. (Author/Year)	Study Classification
Monocots:				
Corn *(Zea mays)*	dry weight	14.4	436781-56 Canning et al. 1994	core
Meadow fescue *(Festuca pratensis)*	damage	8.6		
Purple nutsedge *(Cyperus rotundus)*	dry weight	5.3		
Winter wheat *(Triticum aestivum)*	dry weight	24.6		
Dicots:				
Carrot *(Daucus carota)*	damage	33.2		
Soybean *(Glycine max)*	damage	10.2		
Cocklebur *(Xanthium strumarium)*	damage	16.1		
Morning glory *(Ipomoea hederacea)*	dry weight	10.1		
Rape *(Brassica napus)*	dry weight	27.2		
Sugar beet *(Beta vulgaris)*	dry weight	11.2		
Velvetleaf *(Abutilon theophrasti)*	dry weight	14.8		

[1] TEP (51.6%) testing at 1 lb ai/A, the maximum application rate

[2] only the most sensitive endpoint has been tabulated for each species

For Tier I seedling emergence, carrot damage is the most sensitive dicot endpoint and wheat dry weight is the most sensitive monocot endpoint.

Nontarget Terrestrial Vegetative Vigor Toxicity (Tier I)[1]

Species	Endpoint Affected[2]	% Inhibition	MRID No. (Author/Year)	Study Classification
Monocots:				
Corn *(Zea mays)*	dry weight	8.7	436781-58 (Canning et al. 1994)	core
Purple nutsedge *(Cyperus rotundus)*	dry weight	2.9		
Winter wheat *(Triticum aestivum)*	dry weight	4.9		
Wild oat *(Avena fatua)*	dry weight	11.4		
Dicots:				
Soybean *(Glycine max)*	damage	0.3		
Cocklebur *(Xanthium strumarium)*	damage	0.3		
Morning glory *(Ipomoea hederacea)*	damage	0		
Rape *(Brassica napus)*	dry weight	6.7		
Sugar beet *(Beta vulgaris)*	damage	1.3		
Velvetleaf *(Abutilon theophrasti)*	damage	0.7		

[1] TEP (51.6%) testing at 1 lb ai/A, the maximum label rate

[2] only the most sensitive endpoint has been tabulated for each species

For Tier I vegetative vigor, rape dry weight is the most sensitive dicot endpoint and wild oat dry weight is the most sensitive monocot endpoint.

Tier II tests measure the response of treated plants ($\geq$5 test concentrations) to that of untreated (i.e., control) plants. For azoxystrobin, Tier II testing is not required but seedling emergence testing was conducted for carrot and rape. Those results are tabulated below.

Nontarget Terrestrial Plant Seedling Emergence Toxicity (Tier II)

Species	% ai	Endpoint Affected[1]	EC25 (lb ai/A)	EC05 (lb ai/A)	MRID No. (Author/Year)	Study Classification
Dicots:						
Carrot *(Daucus carota)*	51.6	dry weight	0.59	0.17	436781-60 (Everett et al. 1995)	core
Rape *(Brassica napus)*	51.6	emergence	3.2	0.55		

[1] only the most sensitive endpoint is tabulated

For Tier II seedling emergence, carrot dry weight is the most sensitive endpoint for the two species tested.

Aquatic Plants

Aquatic plant testing is required for any fungicide that has outdoor non-residential terrestrial uses and that may move off-site by runoff (solubility > 10 ppm in water), and/or by drift (aerial or irrigation) or that is applied directly to aquatic use sites (except residential). These conditions do not apply to azoxystrobin but data have been submitted and reviewed. Results of Tier II toxicity testing on the TGAI are tabulated below.

Nontarget Aquatic Plant Toxicity (Tier II)

Species	EC50 (ppm)	NOEC (ppm)	MRID No. (Author/Year)	Study Classification
Vascular Plants:				
Duckweed *(Lemna gibba)*	3.4	0.8	436781-65 (Smyth et al. 1993)	core
Nonvascular Plants:				
Green algae *(Kirchneria subcapitata)*	0.1	0.02[2]	436781-61 (Smyth et al. 1994)	core
Marine diatom *(Skeletonema costatum)*	0.5	0.1	436781-63 (Smyth et al. 1993)	core
Freshwater diatom *(Navicula pelliculosa)*	0.5	0.02	436781-64 (Smyth et al. 1994)	core
Blue-green algae *(Anabaena flos-aquae)*	13	9	436781-62 (Smyth et al. 1993)	core

[1] the test material was 96.2% ai

[2] the EC05 value is tabulated, because an NOEC was not determined

The Tier II results indicate that *Kirchneria subcapitata* is the most sensitive non-vascular aquatic plant. The guideline (123-2) is fulfilled (MRIDs 436781-61, 436781-62, 436781-63, 436781-64, 436781-65).

EXPOSURE AND RISK CHARACTERIZATION

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The means of integrating the results of exposure and ecotoxicity data is called the quotient method. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic.

RQ = EXPOSURE/TOXICITY

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories: (1) **acute high** - potential for acute risk is high regulatory action may be warranted in addition to restricted use classification (2) **acute restricted use** - the potential for acute risk is high, but this may be mitigated through restricted use classification (3) **acute endangered species** - the potential for acute risk to endangered species is high regulatory action may be warranted, and (4) **chronic risk** - the potential for chronic risk is high regulatory action may be warranted. Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies that assess acute effects are: (1) LC50 (fish and birds) (2) LD50 (birds and mammals (3) EC50 (aquatic plants and aquatic invertebrates) and (4) EC25 (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are: (1) LOEC (birds, fish, and aquatic invertebrates) (2) NOEC (birds, fish and aquatic invertebrates) and (3) MATC (fish and aquatic invertebrates). For birds and mammals, the NOEC value is used as the ecotoxicity test value in assessing chronic effects. Other values may be used when justified. Generally, the MATC (defined as the geometric mean of the NOEC and LOEC) is used as the ecotoxicity test value in assessing chronic effects to fish and aquatic invertebrates. However, the NOEC is used if the measurement end point is production of offspring or survival.

Risk presumptions and corresponding RQs and LOCs are tabulated below.

Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Birds		
Acute High Risk	EEC[1]/LC50 or LD50/sqft[2] or LD50/day[3]	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1
Wild Mammals		
Acute High Risk	EEC/LC50 or LD50/sqft or LD50/day	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1

[1] EEC = Estimated Environmental Concentration (ppm) on avian and mammalian food items
[2] mg toxicant/ft² ÷ [LD50 * bird wt (kg)]
[3] mg toxicant consumed/day ÷ [LD50 * bird wt (kg)]

Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute High Risk	EEC[1]/LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/MATC or NOEC	1

[1] EEC = Estimated Environmental Concentration (ppm or ppb) in water

Risk Presumptions for Plants

Risk Presumption	RQ	LOC
	Terrestrial and Semi-Aquatic Plants	
Acute High Risk	EEC[1]/EC25	1
Acute Endangered Species	EEC/EC05 or NOEC	1
	Aquatic Plants	
Acute High Risk	EEC[2]/EC50	1
Acute Endangered Species	EEC/EC05 or NOEC	1

[1] EEC = Estimated Environmental Concentration (lb ai/A)
[2] EEC = Estimated Environmental Concentration (ppb/ppm) in water

Exposure and Risk to Nontarget Terrestrial Animals

For foliar applications, the estimated environmental concentrations (EECs) on food items following pesticide application are compared to LC50 values to assess risk. The predicted 0-day maximum and mean EECs expected on selected avian or mammalian food items immediately following a direct single application at 1 lb ai/A are tabulated below.

Estimated Environmental Concentrations on Avian and Mammalian Food Items (ppm) Following a Single Application at 1 lb ai/A[1]

Food Items	EEC (ppm) Predicted Maximum Residue	EEC (ppm) Predicted Mean Residue
Short grass	240	85
Tall grass	110	36
Broadleaf plants and small insects	135	45
Fruits, pods, seeds, and large insects	15	7

[1] predicted maximum and mean EECs for a 1 lb ai/A application rate are based on Hoerger and Kenaga (1972) as modified by Fletcher et al. (1994). EECs for other application rates are presumed to increase or decrease proportionally with an increase or decrease in the application rate

EECs from multiple applications are estimated from EFED's "FATE" program, based on the maximum application rate (0.55 lb ai/acre), maximum number of applications (9), minimum application interval (14 days), and the degradation rate (aerobic soil metabolic half-life of 164 days). For azoxystrobin, acute exposure EECs for multiple applications are the highest one-day value, whereas chronic exposure EECs are based on 115-day averages (Attachment A). Short grass, insects, and seeds are considered potential food items for birds and mammals on turf sites. Because commercial sod farms and golf courses are mowed and

watered regularly, EECs estimated from "FATE" and the RQs based on them are likely to be lower than predicted.

Birds

Acute and chronic RQs for broadcast applications of azoxystrobin are tabulated below.

Avian Acute RQs for a Single Application, Based on Mallard and Bobwhite Quail LC50 Values of >5200 ppm and a Mallard NOEC of 1200 ppm

Site	Appl. Rate (lb ai/A)	Food Item	Max. EEC (ppm)	Mean EEC (ppm)	Max. Acute RQ (EEC/LC50)	Mean Acute RQ (EEC/LC50)
Turf	0.55	Short grass	132	47	<0.03	<0.01
		Small insects	74	25	<0.01	<0.01
		Seeds/lg. insects	8	4	<0.01	<0.01

The results indicate that avian acute LOCs are not exceeded for a single broadcast application of azoxystrobin on turf for either maximum or mean EECs.

Avian Acute RQs for Multiple Applications, Based on Mallard and Bobwhite Quail LC50 Values >5200 ppm

Site	Appl. Rate (lb ai/A)	No. Appl.	Food Item	Max. EEC (ppm)	Mean EEC (ppm)	Max. Acute RQ (EEC/LC50)	Mean Acute RQ (EEC/LC50)
Turf	0.55	9	Short grass	949	338	<0.18	<0.07
			Small insects	534	180	<0.10	<0.03
			Seeds/lg. insects	59	28	<0.01	<0.01

The results indicate that the avian acute high risk and restricted use LOCs are not exceeded for turf when the maximum number of applications and either maximum or mean EECs are assumed. Although the endangered species LOC might possibly be exceeded (RQ <0.18) if the maximum EEC on short grass substrate is assumed, risk to endangered birds is presumed to be negligible because no treatment-related mortality occurred at 5200 ppm in the avian dietary tests.

Avian Chronic RQs for Multiple Applications, Based on a Mallard Reproduction NOEC of 1200 ppm

Site	Appl. Rate (lb ai/A)	No. Appl.	Food Item	Max. Avg. EEC (ppm)	Mean Avg. EEC (ppm)	Max. Chronic RQ (EEC/LC50)	Mean Chronic RQ (EEC/NOEC)
Turf	0.55	9	Short grass	522	186	0.44	0.16
			Small insects	293	99	0.24	0.08
			Seeds/lg. insects	32	15	0.03	0.01

The avian chronic LOC is not exceeded when the NOEC value from the mallard reproduction study is used with either maximum or mean EECs averaged over 115 days of exposure. However, the chronic risk assessment cannot be completed until acceptable bobwhite quail reproduction data are submitted.

Mammals

EFED's 1995 draft SOP for mammalian risk assessments and residue estimates based on Hoerger and Kenaga (1972) as modified by Fletcher et al. (1994) are used to estimate potential adverse effects of azoxystrobin to wild mammals. The concentration of azoxystrobin in the diet that is expected to be acutely lethal to 50% of the test population (LC50) is determined by dividing the small mammal LD50 value by the % (expressed as a decimal) body weight consumed. An acute RQ is then determined by dividing the EEC by the derived LC50 value. The chronic RQ is determined by dividing the EEC by the NOEC value determined from the two-generation rat reproductive toxicity test. RQs are calculated for three separate weight classes of mammals (15, 35, and 1000 g). Acute and chronic RQs are tabulated below.

Mammalian (Herbivore) Acute RQs for Multiple Applications, Based on a Lab. Rat LD50 of >5000 mg/kg and Maximum and Mean EECs on Short Grass

Site	Appl. Rate (lb ai/A)	No. Appl.	Body Weight (g)	% Body Weight Consumed	Max. EEC (ppm)	Mean EEC (ppm)	Max. Acute RQ[1]	Mean Acute RQ[1]
Turf	0.55	9	15	95	949	338	<0.18	<0.06
			35	66	949	338	<0.13	<0.04
			1000	15	949	338	<0.03	<0.01

[1] RQ = EEC (ppm) ÷ [LD50 (mg/kg)/ % Body Weight Consumed]

The results indicate that the acute high risk and restricted use LOCs are not exceeded for small herbivorous mammals when the maximum number of applications and either maximum or mean EECs are assumed for the initial application. Although the endangered

species LOC might possibly be exceeded (RQ <0.18) if the maximum EEC on short grass substrate is assumed, risk to endangered mammals is considered negligible because the LD50 value exceeds 5000 mg/kg.

Mammalian (Insectivore) Acute RQs for Multiple Applications, Based on a Lab. Rat LD50 of >5000 mg/kg and Maximum and Mean EECs on Small Insects

Site	Appl. Rate (lb ai/A)	No. Appl.	Body Weight (g)	% Body Weight Consumed	Max. EEC (ppm)	Mean EEC (ppm)	Max. Acute RQ[1]	Mean Acute RQ[1]
Turf	0.55	9	15	95	534	180	<0.10	<0.03
			35	66	534	180	<0.07	<0.02
			1000	15	534	180	<0.02	<0.01

[1] RQ = EEC (ppm) ÷ [LD50 (mg/kg)/ % Body Weight Consumed]

The results indicate that no acute LOCs are exceeded for insectivorous mammals when the maximum number of applications and either maximum or mean EECs are assumed for the initial application.

Mammalian (Herbivore/Insectivore) Chronic RQs for Single and Multiple Applications, Based on the Lab. Rat NOEC of 300 ppm

Site	Appl. Rate (lb ai/A)	No. Appl.	Food Item	Max. EEC (ppm)	Mean EEC (ppm)	Max. Chronic RQ (EEC/NOEC)	Mean Chronic RQ (EEC/NOEC)
Turf	0.55	1	Short grass	132	47	0.44	0.16
		9		522	186	1.74*	0.62
		1	Small insects	74	25	0.25	0.08
		9		293	99	0.98	0.33

* exceeds the chronic risk LOC

The results indicate that the chronic risk LOC for small herbivores is exceeded from multiple applications when the maximum number of applications and maximum EEC for the initial application is assumed. The chronic risk LOC for small herbivores is not exceeded for multiple applications when the mean EEC is assumed. Because sod farms and golf courses are mowed and watered regularly, maximum EECs resulting from 9 applications at 14-day intervals would not be expected. Additionally, reduced pup weight is not an endpoint that would likely result in a significant adverse population impact, and no fetal toxicity was observed at 16,500 ppm in the rabbit developmental study. For these reasons, chronic risk is not anticipated.

Insects

Currently, EFED does not assess risk to nontarget insects. Results of acceptable studies are used for recommending appropriate label precautions.

Exposure and Risk to Nontarget Aquatic Animals

EFED calculates EECs using the Generic Expected Environmental Concentration Program (GENEEC). The resultant EECs are used for assessing acute and chronic risks to aquatic organisms. Acute risk assessments are performed using either 0-day EEC values for a single application or peak EEC values for multiple applications. Chronic risk assessments are performed using the 21-day-average EECs for invertebrates and 56-day-average EECs for fish.

The GENEEC program uses basic environmental fate values and pesticide label application information to estimate of the expected environmental concentrations following treatment of 10 hectares. The screening model calculates the concentration of pesticide in a one-hectare, two-meter deep pond, taking into account the following: (1) adsorption to soil or sediment (2) soil incorporation (3) degradation in soil before washoff to a water body and (4) degradation within the water body. The model also accounts for direct deposition of spray drift into the water body (assumed to be 1% and 5% of the application rate for ground and aerial applications, respectively). The maximum number of applications and the minimum interval between applications are included in the calculations. The environmental fate parameters used in the model for this pesticide are: soil K_{OC} = 720, solubility = 6.7 ppm, aerobic soil metabolism half-life = 164 days, the hydrolytic half-life is stable (i.e., >30 days), and water photolytic half-life = 14 days.

Because GENEEC is based on a scenario for agricultural crops (e.g., minimal ground cover, low infiltration rate, high erosive potential), however, EECs likely are overestimated by a factor of 2 for turf (R. Parker/EFED, pers comm., 12/17/96). Turf is characterized by 100% ground cover, high infiltration rates, and lower erosive potential. EFED currently has no refined model for turf, but EECs derived from a Tier II model (PRIZM 2.3/EXAMS 2.97) for azoxystrobin use on grapes were only about one-third of those predicted by GENEEC. For these reasons, EFED estimates that EECs derived from GENEEC may be overestimated 6-fold for turf.

GENEEC-derived and adjusted EECs resulting from applications of azoxystrobin to turf are tabulated below (also see Attachment B).

EECs For Aquatic Exposure

Site	Application Rate (lbs ai/A)	No. Applications	Application Interval (days)	Initial EEC (ppb)	21-day-avg. EEC (ppb)	56-day-avg. EEC (ppb)
Turf	0.55	1	n/a	9	8	7
		9	14	65[1]	57[1]	49[1]
		9	14	11[2]	10[2]	8[2]

[1] GENEEC-derived EEC
[2] adjusted EEC for azoxystrobin on turf

The GENEEC-derived and adjusted EECs may not be appropriate for estuarine waters, because GENEEC is based on runoff into a 1-ha, 2-m deep freshwater pond. Additionally, sod farms and golf courses tend to be scattered rather than concentrated, and runoff into estuarine waters is not likely to be widespread. Twice daily tidal flushing also likely rapidly dilutes any azoxystrobin that may be present.

Freshwater Fish

Acute and chronic RQs are tabulated below for single and multiple applications.

Acute and Chronic RQs for Freshwater Fish, Based On a Rainbow Trout LC50 of 470 ppb and a Fathead Minnow MATC of 168 ppb

Site	Appl. Rate (lbs ai/A)	No. Applications	Initial EEC (ppb)	56-day-avg. EEC (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/MATC)
Turf	0.55	1	9	7	0.02	0.04
		9	65[1]	49[1]	0.14**	0.29
		9	11[2]	8[2]	0.02	0.05

[1] GENEEC-derived EEC
[2] adjusted EEC for azoxystrobin on turf
** exceeds acute restricted use and endangered species LOCs for GENEEC-derived EECs

The results indicate that the acute high risk LOC is not exceeded for turf for single or multiple applications. Based on GENEEC-derived EECs, the restricted use and endangered species LOCs are exceeded for multiple applications. However, no acute risk LOCs are exceeded for the adjusted EECs. The chronic risk LOC is not exceeded.

Freshwater Invertebrates

The acute and chronic RQs are tabulated below for single and multiple applications.

Acute and Chronic RQs for Freshwater Invertebrates, Based On the Waterflea EC50 of 259 ppb and NOEC of 44 ppb

Site	Appl. Rate (lb ai/A)	No. Applications	Initial EEC (ppb)	21-day-avg. EEC (ppb)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOEC)
Turf	0.55	1	9	8	0.03	0.18
		9	65[1]	57[1]	0.25**	1.30*
			11[2]	10[2]	0.04	0.23

[1] GENEEC-derived EEC
[2] adjusted EEC for azoxystrobin on turf
** exceeds acute restricted use and endangered species LOCs
* exceeds the chronic risk LOC

The results indicate that the acute high risk LOC is not exceeded for single or multiple applications. Based on GENEEC-derived EECs, the acute restricted use, endangered species, and chronic LOCs are exceeded for multiple applications. However, no acute or chronic risk LOCs are exceeded for the adjusted EECs.

Estuarine/Marine Fish

Acute RQs are tabulated below for single and multiple applications.

Acute RQs for Estuarine/Marine Fish, Based on a Sheepshead Minnow LC50 of 670 ppb

Site	Appl. Rate (lb ai/A)	No. Applications	Initial EEC (ppb)	Acute RQ (EEC/LC50)
Turf	0.55	1	9	0.01
		9	65	0.10**

** exceeds acute restricted use and endangered species LOCs, based on GENEEC-derived EEC; however, for the reasons noted below, no LOC is presumed to be exceeded

The results indicate that the acute high risk LOC is not exceeded for single or multiple applications on turf. Based on GENEEC-derived EECs, restricted use and endangered species LOCs are equalled or exceeded for multiple applications. However, EFED assumes EECs derived from GENEEC may be overestimated 6-fold even for freshwater ponds, and twice daily tidal flushings of runoff from sod farms and golf courses would further reduce estuarine EECs. Therefore, EFED presumes that no LOC is exceeded.

Estuarine/Marine Invertebrates

Acute RQs are tabulated below for single and multiple applications.

Acute RQs for Estuarine/Marine Aquatic Invertebrates, Based on a Mysid Shrimp LC50 of 56 ppb

Site	Appl. Rate (lb ai/A)	No. Applications	Initial EEC (ppb)	Acute RQ (EEC/LC50)
Turf	0.55	1	9	0.14**
		9	65	1.16***

** exceeds restricted use and endangered species LOCs, based on GENEEC-derived EEC

*** exceeds high risk, restricted use, and endangered species LOCs, based on GENEEC-derived EEC; however, for the reasons noted below, no LOC is presumed to be exceeded

The results from GENEEC-derived EECs indicate that the acute high risk, restricted use, and endangered species LOCs are exceeded for multiple applications on turf. The restricted use and endangered species LOCs also are exceeded for a single application. However, EFED assumes EECs derived from GENEEC may be overestimated 6-fold even for freshwater ponds, and twice daily tidal flushings of runoff from sod farms and golf courses would further reduce estuarine EECs. Therefore, EFED presumes that no LOC is exceeded.

Exposure and Risk to Nontarget Plants

Terrestrial Plants

Terrestrial plants may be exposed to azoxystrobin from runoff, spray drift or volatilization. EFED's runoff scenario is: (1) based on a pesticide's water solubility and the amount of pesticide present on the soil surface and top one inch; (2) characterized as "sheet runoff" (one treated acre to an adjacent untreated acre) for terrestrial plants inhabiting dry areas; (3) characterized as "channelized runoff" (10 treated acres to a distant untreated low-lying acre) for plants inhabiting semi-aquatic areas (i.e., low-lying wet areas that may be dry at certain times of the year); and (4) based on % runoff values of 0.01, 0.02, and 0.05 for water solubility of <10 ppm, 10-100 ppm, and >100 ppm, respectively. Spray drift exposure from ground application is assumed to be 1% of the application rate. Formulae for calculating EECs for terrestrial plants are provided in Attachment C.

EECs and RQs for non-endangered and endangered terrestrial plants (dry and semi-aquatic areas) based on a single application of azoxystrobin are tabulated below.

Acute RQs from a Single Application for Terrestrial Plants, Based On a Carrot Seedling Emergence EC25 of 0.59 lb ai/A and an EC05 of 0.17 lb ai/A

Site	Appl. rate (lb ai/A)	Total Loading to Adjacent Dry Areas (Sheet Runoff+ Drift) (lb ai/A)	Total Loading to Semi-aquatic Areas (Channelized Runoff+ Drift) (lb ai/A)	Dry Area RQs		Semi-Aquatic Area RQs	
				Non-endang. species	Endangered species	Non-endang. species	Endangered species
Turf	0.55	0.011	0.0605	0.02	0.06	0.10	0.35

The results indicate that no plant acute LOCs are exceeded for terrestrial plants for a single application of azoxystrobin at the maximum labeled rate for turf. Risk from drift alone is presumed to be negligible, because the 10 species in Tier I vegetative vigor testing were all inhibited less than 25%. Currently, EFED does not perform assessments for chronic risk to plants.

EECs and RQs for non-endangered and endangered terrestrial plants (dry and semi-aquatic areas) based on multiple applications of azoxystrobin are tabulated below.

Acute RQs From Multiple Applications for Terrestrial Plants, Based On a Carrot Seedling Emergence EC25 of 0.59 lb ai/A and an EC05 of 0.17 lb ai/A

Site	Appl. rate (lb ai/A)	Total Loading to Adjacent Dry Areas (Sheet Runoff+ Drift) (lb ai/A)	Total Loading to Semi-aquatic Areas (Channelized Runoff+ Drift) (lb ai/A)	Dry Area RQs		Semi-Aquatic Area RQs	
				Non-endang. species	Endangered species	Non-endang. species	Endangered species
Turf	0.55 (9 appl.)	0.079	0.435	0.14	0.46	0.74	2.56*

* exceeds the endangered species LOC: however, for the reasons noted below, the LOC is not presumed to be exceeded

The results indicate that multiple applications of azoxystrobin at the maximum labeled rate would not exceed the LOC for non-endangered plants for turf use. The LOC is exceeded for endangered terrestrial plants inhabiting semi-aquatic areas. However, EFED anticipates that runoff would be less than estimated by this scenario developed for agricultural crops. As presumed for GENEEC-derived EECs, runoff from turf is apt to be considerably less (assumed to be one-sixth of calculated EEC) due to the 100% ground cover, high water infiltration rates, and low erosive potential. Therefore, no LOC is presumed to be exceeded.

Aquatic Plants

Exposure to nontarget aquatic plants may occur through runoff and/or spray drift from treated sites. The acute toxicity value for duckweed *(Lemna gibba)* is used to assess risk to aquatic vascular plants. Acute risk to nonvascular aquatic plants is assessed using the most sensitive toxicity value from an algae or diatom species. An aquatic plant risk assessment for acute endangered species is usually made for aquatic vascular plants from the surrogate duckweed. To date there are no known nonvascular plant species on the endangered species list. Runoff and drift exposure is computed from GENEEC. The RQ is calculated by dividing the pesticide's peak concentration in water by the plant EC50 value for acute high risk and by the NOEC value for risk to endangered species.

RQs for vascular and nonvascular plants for single and multiple applications of azoxystrobin are tabulated below.

Acute RQs for Aquatic Plants, Based Upon a Duckweed (*Lemna gibba*) EC50 of 3.4 ppm and an NOEC of 0.8 ppm and a Nonvascular Plant (*Kirchneria subcapitata*) EC50 of 0.1 ppm

Site	Appl. Rate (lb ai/A)	No. Appl.	Test Species	Peak EEC (ppb)	Acute RQ (EEC/EC50)	Endangered Species RQ (EEC/NOEC)
Turf	0.55	1	duckweed	9	0.003	0.01
		1	algae	9	0.09	n/a
		9	duckweed	65	0.02	0.08
		9	algae	65	0.65	n/a

The results indicate that LOCs are not exceeded for vascular or nonvascular plants for either single or multiple applications on turf. Currently, EFED does not perform assessments for chronic risk to plants.

Endangered Species

No endangered species concerns are presumed for the proposed use of azoxystrobin on sod farms and golf courses.

LABELING

End-use product: "This pesticide is toxic to freshwater and estuarine/marine fish and aquatic invertebrates. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high-water mark. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate."

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12-20-96

ATTACHMENT A: "FATE" RESULTS

SHORT GRASS

Initial concentration (ppm): 132 (maximum EEC, short grass)
Half-life: 164 days
No. applications: 9
Application interval: 14 days
Length of simulation: 115 days
Highest 1-day residue (EEC): 948.5979 ppm
115-day average residue (EEC): 521.8383 ppm

Daily residues (ppm):

Day - ppm		
0 - 132	41 - 353.7057	84 - 779.1402
1 - 131.4433	42 - 484.2139	85 - 775.854
2 - 130.8889	43 - 482.1717	86 - 772.582
3 - 130.3369	44 - 480.1381	87 - 769.3235
4 - 129.7872	45 - 478.1131	88 - 766.0788
5 - 129.2398	46 - 476.0966	89 - 762.8478
6 - 128.6947	47 - 474.0886	90 - 759.6304
7 - 128.1519	48 - 472.0891	91 - 756.4266
8 - 127.6114	49 - 470.098	92 - 753.2363
9 - 127.0732	50 - 468.1154	93 - 750.0594
10 - 126.5373	51 - 466.141	94 - 746.896
11 - 126.0036	52 - 464.175	95 - 743.746
12 - 125.4722	53 - 462.2174	96 - 740.6091
13 - 124.943	54 - 460.2679	97 - 737.4855
14 - 256.416	55 - 458.3267	98 - 866.3751
15 - 255.3345	56 - 588.3936	99 - 862.7209
16 - 254.2577	57 - 585.9121	100 - 859.0824
17 - 253.1853	58 - 583.4409	101 - 855.4592
18 - 252.1175	59 - 580.9802	102 - 851.8512
19 - 251.0542	60 - 578.5299	103 - 848.2584
20 - 249.9953	61 - 576.0899	104 - 844.6809
21 - 248.9409	62 - 573.6602	105 - 841.1184
22 - 247.891	63 - 571.2407	106 - 837.571
23 - 246.8455	64 - 568.8315	107 - 834.0383
24 - 245.8044	65 - 566.4323	108 - 830.5206
25 - 244.7677	66 - 564.0433	109 - 827.0179
26 - 243.7354	67 - 561.6645	110 - 823.53
27 - 242.7074	68 - 559.2956	111 - 820.0565
28 - 373.6837	69 - 556.9366	112 - 948.5979
29 - 372.1077	70 - 686.5878	113 - 944.5971
30 - 370.5383	71 - 683.692	114 - 940.6132
31 - 368.9755	72 - 680.8085	115 - 936.6461
32 - 367.4193	73 - 677.9371	
33 - 365.8697	74 - 675.0779	
34 - 364.3266	75 - 672.2307	
35 - 362.7901	76 - 669.3955	
36 - 361.26	77 - 666.5723	
37 - 359.7363	78 - 663.761	
38 - 358.2191	79 - 660.9614	
39 - 356.7083	80 - 658.1737	
40 - 355.2038	81 - 655.3979	
	82 - 652.6337	
	83 - 649.8811	

Initial concentration (ppm): 47 (mean EEC, short grass)
Half-life: 164 days
No. applications: 9
Application interval: 14 days
Length of simulation: 115 days
Highest 1-day residue (EEC): 337.7583 ppm
115-day average residue (EEC): 185.8061 ppm

Daily residues (ppm):

Day - ppm		
0 - 47	45 - 170.2372	92 - 268.1978
1 - 46.80178	46 - 169.5192	93 - 267.0666
2 - 46.60439	47 - 168.8043	94 - 265.9403
3 - 46.40783	48 - 168.0924	95 - 264.8186
4 - 46.2121	49 - 167.3834	96 - 263.7017
5 - 46.0172	50 - 166.6774	97 - 262.5896
6 - 45.82311	51 - 165.9745	98 - 308.482
7 - 45.62985	52 - 165.2745	99 - 307.181
8 - 45.4374	53 - 164.5774	100 - 305.8854
9 - 45.24576	54 - 163.8833	101 - 304.5953
10 - 45.05493	55 - 163.1921	102 - 303.3107
11 - 44.86492	56 - 209.5038	103 - 302.0314
12 - 44.67569	57 - 208.6202	104 - 300.7576
13 - 44.48727	58 - 207.7403	105 - 299.4891
14 - 91.29964	59 - 206.8642	106 - 298.226
15 - 90.91458	60 - 205.9917	107 - 296.9682
16 - 90.53114	61 - 205.1229	108 - 295.7157
17 - 90.14931	62 - 204.2578	109 - 294.4685
18 - 89.76909	63 - 203.3963	110 - 293.2266
19 - 89.39049	64 - 202.5385	111 - 291.9899
20 - 89.01348	65 - 201.6842	112 - 337.7583
21 - 88.63806	66 - 200.8336	113 - 336.3338
22 - 88.26422	67 - 199.9866	114 - 334.9153
23 - 87.89195	68 - 199.1431	115 - 333.50283
24 - 87.52126	69 - 198.3032	
25 - 87.15213	70 - 244.4669	
26 - 86.78456	71 - 243.4358	
27 - 86.41853	72 - 242.4091	
28 - 133.0541	73 - 241.3867	
29 - 132.4929	74 - 240.3687	
30 - 131.9341	75 - 239.3549	
31 - 131.3777	76 - 238.3454	
32 - 130.8236	77 - 237.3401	
33 - 130.2718	78 - 236.3391	
34 - 129.7224	79 - 235.3423	
35 - 129.1752	80 - 234.3498	
36 - 128.6304	81 - 233.3614	
37 - 128.0879	82 - 232.3771	
38 - 127.5477	83 - 231.3971	
39 - 127.0098	84 - 277.4212	
40 - 126.4741	85 - 276.2511	
41 - 125.9407	86 - 275.086	
42 - 172.4095	87 - 273.9258	
43 - 171.6823	88 - 272.7705	
44 - 170.9573	89 - 271.62	
	90 - 270.4745	
	91 - 269.3337	

SMALL INSECTS

Initial concentration (ppm): 74 (maximum EEC, small insects)
Half-life: 164 days
No. applications: 9
Application interval: 14 days
Length of simulation: 115 days
Highest 1-day residue (EEC): 531.7898 ppm
115-day average residue (EEC): 292.5458 ppm

Daily residues (ppm):

Day - ppm		
0 - 74	43 - 270.3084	88 - 429.4684
1 - 73.6879	44 - 269.1683	89 - 427.6571
2 - 73.37711	45 - 268.0331	90 - 425.8534
3 - 73.06765	46 - 266.9027	91 - 424.0574
4 - 72.75947	47 - 265.777	92 - 422.2688
5 - 72.4526	48 - 264.656	93 - 420.4879
6 - 72.14703	49 - 263.5398	94 - 418.7144
7 - 71.84274	50 - 262.4283	95 - 416.9484
8 - 71.53973	51 - 261.3215	96 - 415.19
9 - 71.23801	52 - 260.2193	97 - 413.4388
10 - 70.93756	53 - 259.1219	98 - 485.6951
11 - 70.63838	54 - 258.029	99 - 483.6467
12 - 70.34045	55 - 256.9407	100 - 481.6068
13 - 70.04379	56 - 329.857	101 - 479.5756
14 - 143.7484	57 - 328.4659	102 - 477.553
15 - 143.1421	58 - 327.0805	103 - 475.5389
16 - 142.5384	59 - 325.701	104 - 473.5333
17 - 141.9372	60 - 324.3273	105 - 471.5361
18 - 141.3386	61 - 322.9595	106 - 469.5473
19 - 140.7425	62 - 321.5974	107 - 467.567
20 - 140.1489	63 - 320.241	108 - 465.595
21 - 139.5578	64 - 318.8904	109 - 463.6313
22 - 138.9692	65 - 317.5454	110 - 461.6759
23 - 138.3831	66 - 316.2061	111 - 459.7287
24 - 137.7994	67 - 314.8725	112 - 531.7898
25 - 137.2183	68 - 313.5445	113 - 529.5469
26 - 136.6395	69 - 312.2221	114 - 527.3135
27 - 136.0632	70 - 384.9053	115 - 525.0895
28 - 209.4894	71 - 383.2819	
29 - 208.6058	72 - 381.6654	
30 - 207.726	73 - 380.0557	
31 - 206.8499	74 - 378.4527	
32 - 205.9775	75 - 376.8566	
33 - 205.1088	76 - 375.2672	
34 - 204.2437	77 - 373.6845	
35 - 203.3823	78 - 372.1084	
36 - 202.5245	79 - 370.539	
37 - 201.6704	80 - 368.9762	
38 - 200.8198	81 - 367.42	
39 - 199.9728	82 - 365.8704	
40 - 199.1294	83 - 364.3273	
41 - 198.2896	84 - 436.7907	
42 - 271.4533	85 - 434.9485	
	86 - 433.1141	
	87 - 431.2874	

Initial concentration (ppm): 25 (mean EEC, small insects)
Half-life: 164 days
No. applications: 9
Application interval: 14 days
Length of simulation: 115 days
Highest 1-day residue (EEC): 179.6587 ppm
115-day average residue (EEC): 98.833 ppm

Daily residues (ppm):

Day - ppm		
0 - 25	45 - 90.55172	92 - 142.6584
1 - 24.89456	46 - 90.16981	93 - 142.0567
2 - 24.78957	47 - 89.78951	94 - 141.4576
3 - 24.68501	48 - 89.41081	95 - 140.861
4 - 24.5809	49 - 89.03372	96 - 140.2669
5 - 24.47723	50 - 88.65821	97 - 139.6753
6 - 24.374	51 - 88.28429	98 - 164.0862
7 - 24.2712	52 - 87.91194	99 - 163.3941
8 - 24.16883	53 - 87.54117	100 - 162.705
9 - 24.0669	54 - 87.17195	101 - 162.0188
10 - 23.96539	55 - 86.80429	102 - 161.3355
11 - 23.86432	56 - 111.4382	103 - 160.655
12 - 23.76367	57 - 110.9682	104 - 159.9774
13 - 23.66344	58 - 110.5002	105 - 159.3027
14 - 48.56364	59 - 110.0341	106 - 158.6309
15 - 48.35882	60 - 109.5701	107 - 157.9618
16 - 48.15486	61 - 109.1079	108 - 157.2956
17 - 47.95176	62 - 108.6478	109 - 156.6322
18 - 47.74952	63 - 108.1895	110 - 155.9716
19 - 47.54814	64 - 107.7332	111 - 155.3137
20 - 47.3476	65 - 107.2789	112 - 179.6587
21 - 47.14791	66 - 106.8264	113 - 178.901
22 - 46.94905	67 - 106.3758	114 - 178.1464
23 - 46.75104	68 - 105.9272	115 - 177.3951
24 - 46.55386	69 - 105.4804	
25 - 46.35752	70 - 130.0356	
26 - 46.16201	71 - 129.4871	
27 - 45.96731	72 - 128.941	
28 - 70.77344	73 - 128.3972	
29 - 70.47495	74 - 127.8557	
30 - 70.17771	75 - 127.3164	
31 - 69.88173	76 - 126.7795	
32 - 69.58699	77 - 126.2447	
33 - 69.2935	78 - 125.7123	
34 - 69.00125	79 - 125.1821	
35 - 68.71024	80 - 124.6541	
36 - 68.42045	81 - 124.1284	
37 - 68.13188	82 - 123.6049	
38 - 67.84452	83 - 123.0835	
39 - 67.55838	84 - 147.5644	
40 - 67.27345	85 - 146.9421	
41 - 66.98971	86 - 146.3223	
42 - 91.70718	87 - 145.7052	
43 - 91.32041	88 - 145.0907	
44 - 90.93513	89 - 144.4788	
	90 - 143.8694	
	91 - 143.2626	

ATTACHMENT B: GENEEC-DERIVED AQUATIC EECS FOR SINGLE AND MULTIPLE APPLICATIONS TO TURF

INPUT VALUES

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP DEPTH(IN)
.550(.550)	1	1	720.0	6.7	1.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
164.00	2	N/A	14.00- 1717.80	.00	1717.80

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
8.86	8.69	7.84	6.71

INPUT VALUES

RATE (#/AC) ONE(MULT)	APPLICATIONS NO.-INTERVAL		SOIL KOC	SOLUBILITY (PPM)	% SPRAY DRIFT	INCORP DEPTH(IN)
.550(3.952)	9	14	720.0	6.7	1.0	.0

FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)

METABOLIC (FIELD)	DAYS UNTIL RAIN/RUNOFF	HYDROLYSIS (POND)	PHOTOLYSIS (POND-EFF)	METABOLIC (POND)	COMBINED (POND)
164.00	0	N/A	14.00- 1717.80	.00	1717.80

GENERIC EECs (IN PPB)

PEAK GEEC	AVERAGE 4 DAY GEEC	AVERAGE 21 DAY GEEC	AVERAGE 56 DAY GEEC
64.27	63.49	57.30	49.03

ATTACHMENT C: PLANT EEC FORMULAE AND CALCULATIONS FOR A SINGLE APPLICATION TO TURF[1]

Ground application (unincorporated) for terrestrial plants inhabiting dry areas adjacent to treatment sites

Runoff = maximum application rate (0.55 lb ai/A) x runoff value (0.01)
= 0.0055 lb ai/A
Drift = maximum application rate x 1%
= 0.0055 lb ai/A
Total Loading = runoff + drift
= 0.011 lb ai/A

Ground application (unincorporated) for terrestrial plants inhabiting semi-aquatic (i.e., wet, low-lying) areas

Runoff = max. appl. rate (0.55 lb ai/A) x runoff value (0.01) x 10 acres
= 0.055 lb ai/A
Drift = max. appl. rate x 1%
= 0.0055 lb ai/A
Total Loading = runoff + drift
= 0.0605 lb ai/A

[1] Total loading for multiple applications is estimated from EFED's "FATE" program and is based on the estimated runoff or drift (lb ai/acre) from one application, the maximum number of applications allowed, the minimum interval (days) between applications, and the half-life (days) of the active ingredient. Runoff and drift values are determined separately and total loading estimated by combining the two values.

Date: 12/16/96
Case No: 005533
Chemical No: 128810

NEW CHEMICAL REVIEW
DATA REQUIREMENTS FOR AZOXYSTROBIN
ECOLOGICAL EFFECTS BRANCH

Data Requirement	Composition[1]	Use Pattern[2]	Does EPA Have Data to Satisfy This Requirement? (Yes/No)	Bibliographical Citation	Must Additional Data Be Submitted Under FIFRA 3(c)(2)(B)?
6 Basic Studies in Bold					
71-1(a) Acute Avian Oral, Quail/Mallard	TGAI	C	Yes	436781-08, 436781-09	No
71-1(b) Acute Avian Oral, Quail/Mallard					
71-2(a) Acute Avian Dietary, Quail	TGAI	C	Yes	436781-10	No
71-2(b) Acute Avian Dietary, Mallard	TGAI	C	Yes	436781-11	No
71-3 Wild Mammal Toxicity					
71-4(a) Avian Reproduction, Quail	TGAI	C	No	436781-12[3]	Yes
71-4(b) Avian Reproduction, Mallard	TGAI	C	Yes	436781-13	No
71-5(a) Simulated Terrestrial Field Study					
71-5(b) Actual Terrestrial Field Study					
72-1(a) Acute Fish Toxicity, Bluegill	TGAI	C	Yes	436781-14	No
72-1(b) Acute Fish Toxicity, Bluegill					
72-1(c) Acute Fish Toxicity, Rainbow Trout	TGAI	C	Yes	436781-15	No
72-1(d) Acute Fish Toxicity, Rainbow Trout	DEGR	C	Yes[4]	441588-03	No
72-2(a) Acute Aquatic Invertebrate Toxicity	TGAI	C	Yes	436781-16	No
72-2(b) Acute Aquatic Invertebrate Toxicity	DEGR	C	Yes[4]	441588-01, -02, -04	No
72-3(a) Acute Estu/Marine Toxicity, Fish	TGAI	C	Yes	436781-17	No
72-3(b) Acute Estu/Marine Toxicity, Mollusk	TGAI	C	Yes	436781-18	No
72-3(c) Acute Estu/Marine Toxicity, Shrimp	TGAI	C	Yes	436781-19	No
72-3(d) Acute Estu/Marine Toxicity, Fish					
72-3(e) Acute Estu/Marine Toxicity, Mollusk					

Date: 12/16/96
Case No: 005533
Chemical No: 128810

NEW CHEMICAL REVIEW
DATA REQUIREMENTS FOR AZOXYSTROBIN
ECOLOGICAL EFFECTS BRANCH

Data Requirement	Composition[1]	Use Pattern[2]	Does EPA Have Data to Satisfy This Requirement? (Yes/No)	Bibliographical Citation	Must Additional Data Be Submitted Under FIFRA 3(c)(2)(B)?
72-3(f) Acute Estu/Marine Toxicity, Shrimp					
72-4(a) Early Life-Stage, Fish	TGAI	C	Yes	436781-20	No
72-4(b) Life-Cycle Aquatic Invertebrate	TGAI	C	Yes	436781-21	No
72-5 Life-Cycle Fish	TGAI	C	No		No[5]
72-6 Aquatic Organism Accumulation					
72-7(a) Simulated Aquatic Field Study					
72-7(b) Actual Aquatic Field Study					
122-1(a) Seedling Emergence	TGAI or TEP	C	Yes[6]	436781-56	No
122-1(b) Vegetative Vigor	TGAI or TEP	C	Yes[6]	436781-58	No
122-2 Aquatic Plant Growth					
123-1(a) Seedling Emergence	TGAI or TEP	C	Yes[6]	433454-60	No
123-1(b) Vegetative Vigor					
123-2 Aquatic Plant Growth	TGAI or TEP	C	Yes[6]	436781-61, -62, -63 436781-64, -65	No
141-1 Honey Bee Acute Contact	TGAI	C	Yes	436781-66, -67[7]	No
141-2 Honey bee Residue on Foliage					

[1] Composition: TGAI=Technical grade of the active ingredient; PAIRA=Pure active ingredient; TEP=Typical end-use product

[2] Use Patterns: A=Terrestrial Food Crop; B=Terrestrial Feed Crop; C=Terrestrial Non-Food Crop; D=Aquatic Food Crop; E=Aquatic Non-Food Outdoor; F=Aquatic Non-food Industrial; G=Aquatic Non-Food Residential; H=Greenhouse Food Crop; I=Greenhouse Non-Food Crop; J=Forestry; K=Outdoor Residential; L=Indoor Food; M=Indoor Non-Food; N=Indoor Medical; O=Indoor Residential; Z=Use Group for Site 00000

[3] Invalid study

[4] Degradate testing is not required, but studies were submitted and reviewed

[5] The study is triggered based on a GENEEC-derived 56-day-average EEC of 49 ppb, which is >0.1 of the NOEC (0.1 x 147 ppb = 14.7 ppb) in the fish early life-stage test; however, because GENEEC is presumed to overestimate EECs 6-fold for azoxystrobin use on turf, the adjusted EEC of 8 ppb (i.e., 8 ppb <14.7 ppb) does not trigger this study for turf use

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[6] Plant testing is not required, but studies were submitted and reviewed

[7] The study submitted for the formulated product is not required