AZOXYSTROBIN NEW USES: RISK ASSESSMENT

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SUBJECT: Azoxystrobin (128810) in/on Barley, Bulb Vegetables, Citrus Fruits, Corn (Field & Sweet Corn), Cotton, Root & Tuber Vegetables, Tops of Root & Tuber Vegetables, Leafy Vegetables & Cilantro, Peanuts, Soybeans, and Wild Rice. DP: D260137

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The Environmental Risk Branch III of EFED has completed the environmental fate and effects risk assessment for the proposed new uses of azoxystrobin. This report uses the information provided in the June 23, 1998 review of azoxystrobin use on Muscadines, Plantains, Almonds, Tree Nuts, Pistachios, Rice, Cucurbits, and Wheat to develop a comparative risk assessment of the new uses against previous uses. The comparison was made primarily on application rates, and crop types; however, agricultural conditions (temperature, rainfall, and soil series) were also considered.

Application information for the proposed new uses of azoxystrobin is tabulated below.

Crop	Application Rate (lb ai/A)	Number of Applications	Interval (days between application)	Maximum lb ai/A/year
Barley	0.1 - 0.2	2 - 4		0.4
Bulb Vegetables	0.1 - 0.25	6 - 15	5 - 7	1.5
Citrus Fruit	0.2 - 0.25	6 - 7	7 - 21	1.5
Corn	0.1 - 0.25	8 - 20	7 - 14	2
Cotton	0.1 - 0.2 oz ai per 1000ft of row	1 - 2	0	0.2 oz ai per 1000ft of row (0.172 lb ai/A/year)
Tuber Vegetables	0.1 - 0.33	6 - 20	7 - 14	2
Leafy Vegetables	0.1 - 0.25	6 - 15	5 - 7	1.5
Peanut	0.1 - 0.4	2 - 8	10 -14	0.8
Soybean	0.15 - 0.25	6 - 10		1.5
Wild Rice	0.1 - 0.3	2 - 7	7 - 14	0.7

Risk Overview

Although moderately persistent in soils and stable to hydrolysis, the likelihood of azoxystrobin moving into ground and surface water is low due to high soil/water partitioning coefficients and low single application rates. However, with multiple applications and repeated usage, azoxystrobin and especially its degradate (compound 2) could accumulate in environmental compartments and move into drinking water resources. Compound 2 has greater potential to leach into ground water than the parent as indicated in the terrestrial field studies. In these studies, parent azoxystrobin remained on the soil surface whereas compound 2 was detected in deeper soil profiles.

Based on information provided in the June 23, 1998 report and the application patterns of the proposed new uses, the following risks are presumed for the new uses.

	Acute High Risk	Acute Restricted Use	Acute Endangered Species	Chronic Risk
Birds & Mammals				
Freshwater Fish		Wild Rice, Tuber Vegetables, and Citrus Fruits	Wild Rice, Tuber Vegetables, and Citrus Fruits	
Freshwater Invertebrates		Wild Rice, Tuber Vegetables, and Citrus Fruits	Wild Rice, Tuber Vegetables, and Citrus Fruits	Wild Rice
Estuarine/Marine Fish				
Estuarine/Marine Invertebrates	Tuber Vegetables	Citrus Fruit, Corn, Tuber Vegetables, Leafy Vegetables, Peanut, and Soybean	* Citrus Fruit, Corn, Tuber Vegetables, Leafy Vegetables, Peanut, and Soybean	Citrus Fruit, Corn, Tuber Vegetables, Leafy Vegetables, Peanut, and Soybean
Terrestrial plants				
Aquatic Plants	Wild Rice			

* - Note that there are no federally listed threatened or endangered estuarine/marine invertebrate species.

The acute high risk of tuber vegetables to estuarine/marine invertebrates, and wild rice to aquatic plants may be mitigated by reducing the single application rate and the number of applications.

Due to low usage rates, minimal risk is presumed for barley and cotton.

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Environmental Fate

According to previously submitted data, the primary dissipation pathway of azoxystrobin is by photodegradation in soil (t ½ = 18 to 28 days) and water (t ½ = 11 to 17 days). Azoxystrobin is also susceptible to runoff and leaching due to its stability to hydrolysis and its moderate persistence in aerobic (DT_{50} = 54 to 164 days) and anaerobic soils (DT_{50} = 49 to 56 days). However, EFED believes that the magnitude of the azoxystrobin partitioning coefficients (K_d = 1.5 to 23 mL/g) will limit its potential to leach into ground water. Also, since azoxystrobin is mostly foliarly applied to treat fungal diseases, foliar interception and subsequent photodegradation on foliage could substantially reduce the amount of azoxystrobin reaching soil surfaces, and consequently the amount available for leaching and runoff. Azoxystrobin transformation products, Compound 2 (R234886), Compound 28 (R401553), and Compound 30 (R402173), exhibit much lower soil/binding affinity (K_d = 0.35 to 11 mL/g) than the parent compound, thus possessing greater potential to leach through soils. One of the degradates, Compound 2, appears to be the most mobile degradate: it was detected in a majority of laboratory studies and was also observed to leach through soil in the terrestrial field dissipation (<1% of total applied) and aquatic soil dissipation studies (<5% of total applied). No persistence and dissipation rates have been reported for this degradate.

Ground and Surface Water Concerns

Although azoxystrobin is moderately persistent in laboratory studies, EFED believes that significant concentrations of azoxystrobin in ground water as a result of the proposed new uses are unlikely since the leaching potential of this chemical is limited by its high soil/water partitioning. Compound 2 has greater potential for moving into ground water than parent azoxystrobin, but it is also not predicted to pose a major ground water concern due to the low single application rate of the parent. However, with multiple applications, azoxystrobin and its degradate may build up in environmental compartments and enter ground water resources. Therefore, if azoxystrobin use increases significantly, additional information of persistence and dissipation of Compound 2 may be required to accurately determine its potential for accumulating in the environment.

Drinking Water Resource Assessment

Presented below is a summary of the Drinking Water Assessment reported in the June 23, 1998 review. Tier I drinking water EECs were estimated using GENEEC (Generic Expected Environmental Concentration) and SCI-GROW (Screening Concentration in Ground Water) models. Since azoxystrobin is a new chemical, monitoring data are not available to confirm surface and ground water estimated environmental concentrations (EECs).

Ground Water Modeling (Previous Uses)

The SCI-GROW screening model developed in EFED estimates potential ground water

concentrations under hydrologically vulnerable conditions. Based on the highest use rate (turf use, 9 applications per year, 10-day interval, and 0.55 lb ai/A/application), the upper-bound concentration of azoxystrobin was estimated at 0.06 ppb.

Surface Water Modeling (Previous Uses)

The GENEEC model indicates that the surface water concentration of azoxystrobin on a variety of crops ranged from 13 ppb for wheat to 141 ppb for turf.

Crops	Application Rate (lb ai/A)	No. of Appl.	Application Interval	Initial EEC (ppb)	21-day EEC (ppb)	56-60-day EEC (ppb)
Wheat	0.20	2	10	13	13	12
Bananas	0.10-0.135	8	5-12	31	29	28
Pecans	0.15-0.20	6-8	7	37	36	33
Grapes	0.25	6	7-10	46	44	42
Turf	0.55	9	10	141	135	127
Rice *	0.25	3	7	117	108	95

* Modified GENEEC (GENEECX) for aquatic use.

New Uses: Surface and Water EECs

It is not expected that the proposed new uses will result in drinking water EECs higher that the maximum reported values from previous uses. Therefore, additional model runs were not conducted for the proposed new uses.

Aquatic Exposure

Refined EECs for Aquatic Exposure (Previous Uses)

Refined Tier II estimated environmental surface water concentrations presented below were based on PRZM (Pesticide Root Zone Model version 3.1) and EXAMS (Exposure Analysis Modeling Systems version 2.97.5) models. Refined surface water concentrations (as reported in the June 23, 1998 review) were developed for almond, cucurbit, grape, and peanut crop scenarios.

Crop	Application method	Application rate #appl/interv	Peak Initial (ppb)	4-day average (ppb)	21-day average (ppb)	60-day average (ppb)	90-day average (ppb)	yearly (ppb)
Almond	Airblast/ Aerial	0.25 lb ai/A 6/10 days	4.1	4.1	3.8	3.5	3.2	2.1
Cucurbits	Aerial	0.25 lb ai/A 6/7 days	32	31	30	28	26	14
Grapes	Airblast/ Aerial	0.25 lb ai/A 6/14	5	4.9	4.6	4.2	3.9	2.7
Peanuts	Aerial	0.4 lb ai/A 2/30	11.3	11.1	10.3	9.5	8.8	4.1

EFED did not perform additional aquatic exposure modeling for the proposed new uses. Rather, exposure potential associated with these new uses was assessed by comparing the application patterns (single application rate and application interval) and modeling scenarios (soil texture, slope of land, location, rainfall, and temperature) of the proposed new crops against the previously modeled crops which are listed above.

1. Wild rice is grown predominantly in natural stands in the Great Lakes region. Because of similarities in use sites, the exposure from wild rice is expected to be comparable to the value previously reported for rice (Tier I GENEECX model).

2. Barley and cotton EECs are compared against peanut EECs based on application rates. It is expected that the EECs of barley and cotton will not exceed the values reported for peanuts (Tier II model).

3. Although the application rates for corn, bulb vegetables, leafy vegetables, and soybean are similar to cucurbits, EFED believes that the EECs for these new proposed crops would be lower than cucurbit EECs, based on modeling scenarios. However, the EECs are not expected to be lower than for peanuts, based on application rates (Tier II model).

4. Citrus fruit is compared against almonds and cucurbits due to their similar application rates. The modeling scenarios for citrus fruit and cucurbit are quite comparable; however, due to greater foliar interception of azoxystrobin by citrus fruit, the amount of azoxystrobin available for runoff from citrus fruit should be much less than from cucurbits. Therefore, EFED expects the EECs for citrus fruit to be lower than cucurbits but higher than almonds. The comparison to almonds was based on the lower levels of rainfall in California (almond) as compared to Florida (citrus fruit) (Tier II model).

5. Tuber vegetables have a relatively high use rate. The model scenario for tuber vegetables are based on poorly drained soils (South Central Panhandle) which are subjected to

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flooding and runoff. Therefore, the use of azoxystrobin on this crop may lead to higher surface water concentrations than on cucurbits. Based on a linear extrapolation of the EEC values for cucurbits, 6 applications of 0.33 lb ai/A/each will yield average EECs of 42 ppb for peak, 40 ppb for 21-day, and 37 ppb for 60-day. EFED expects the EECs for tuber vegetables to be comparable to or slightly higher than these extrapolated values (Tier II model).

Ecological Risks

According to the above aquatic exposure assessment and the RQ values from the June 23, 1998 report, the following ecological risks are presumed for the proposed new uses. Table I summarizes the risk conclusions from the previous uses and how those conclusions relate to the proposed new patterns.

1. Terrestrial animals: Minimal acute and chronic risks are presumed for birds and mammals.

2. Freshwater animals:

- Based on the RQs for rice, the following risk presumptions are met for azoxystrobin use on wild rice for aquatic invertebrates: acute restricted use, acute endangered species and chronic risk. Note that the wild rice aquatic exposure assessment was based on a modified GENEEC model for rice use and the estimates should be considered conservative.

- Based on the RQ for cucurbits, the following risk presumptions are met for azoxystrobin use on tuber vegetables for freshwater animals: acute restricted use, acute endangered species

- Acute high risk for freshwater animals is not presumed for any of the new proposed uses. Except for wild rice, chronic risk is minimal for all uses.

3. Estuarine/marine animals: The following proposed new crops are used in coastal counties: citrus fruit, corn, cotton, tuber vegetables, leafy vegetables, peanuts, and soybeans. Azoxystrobin residues from these uses may therefore enter estuarine/marine environments. Since peanuts has the lowest use pattern among these crops (except for cotton), risks to estuarine/marine animals were assessed based on the EECs reported for peanuts in the June 23, 1998 review. Cotton is not expected to pose any adverse effect on estuarine/marine animals due to low application rates. The following risk assessment applies to citrus fruit, corn, tuber vegetables, leafy vegetables, peanuts and soybeans, unless noted otherwise.

- No risks are presumed to estuarine/marine fish.

- Acute endangered species risks are presumed for estuarine/marine invertebrates.

However, currently there are no federally-listed threatened or endangered estuarine / marine invertebrate species.

- Acute restricted use and chronic risks are presumed for estuarine/marine invertebrates.
- Acute high risk is presumed for estuarine/marine invertebrates for tuber vegetable use only.

4. Plants: High risk to aquatic plants is presumed for non-vascular species exposed to azoxystrobin from treated wild rice. Risks to terrestrial plants (non-endangered and endangered), and endangered aquatic plants is minimal for all other proposed new uses.

Uncertainties in the Risk Assessment

Because of the relatively low overall risk from azoxystrobin and the similarities between the new uses and the previously assessed uses, EECs for aquatic exposure were not modeled for the proposed new uses. Rather, a comparison to risks from existing uses was conducted to derive an ecological risk assessment for the proposed new uses. This comparative analysis was judged appropriate based on the similarity between existing and new crops (comparable use rates) and low toxicity of azoxystrobin to most non-target organisms. EFED believes that uncertainties do exist in such an assessment; however, these uncertainties are not expected to significantly alter the risk pattern for azoxystrobin as established in the "Ecological Risks" section of this report.

Endangered Species Concerns

Endangered species LOCs are exceeded for freshwater fish, freshwater invertebrates, and aquatic plants. Zeneca should address these concerns via the Endangered Species Task Force.

Labeling

The labeling recommended in the June 23, 1998 review is applicable to these new proposed uses.

Acknowledgment

The review team for azoxystrobin thanks Dr. James Lin for assisting with the surface water modeling; and Drs. Ron Bloom and William Erickson for performing the secondary review of this report.

If you have questions concerning this review, please contact Thuy Nguyen at 703-605-0562

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Table 1 - **Risk Conclusions from previous assessment, and how those conclusions relate to proposed use patterns**

Uses previously reviewed		Risk conclusions from previous review				Proposed Use patterns to which this risk applies	
Site Appl. Rate (lbs ai/A), (No Appl.) and Max appl (ai / acre /yr)	Peak EEC and long-term EEC	Freshwater Fish acute toxicity: LC50=470 ppb chronic toxicity: MATC=468 ppb	Freshwater Inverts acute toxicity: EC50=259 ppb chronic toxicity: NOAEC=44 ppb	Estuarine Fish acute toxicity: LC50=670 ppb no chronic tox data	Estuarine Invertebrates acute toxicity: EC50=56 ppb chronic toxicity: NOAEC=9.5 ppb	Use Site	Use Rate and total applied per season
			PRZM2/EXAM II				
Cucurbits 0.25 lb (6) 1.5 lb	32 ppb 28 ppb	Exceeds Endangered Species LOC	Exceeds Restricted Use and Endangered Species LOCs	No LOC exceedance[1]	Exceeds High Acute, Restricted Use, Chronic Risk LOCs[1]	Tuber vegetables	0.1-0.33 lb ai/acre Max 2 lb ai/acre/year
						Citrus	0.2 - 0.25 lb ai/acre Max 1.5 lb ai/acre/year
Peanuts 0.4 lb (2) 0.8 lb	11 ppb 10 ppb	No LOC exceedance	No LOC exceedance	No LOC exceedance	Exceeds Restricted Use Chronic Risk LOCs	Bulb veg. Leafy veg. Corn Soybeans	0.1 - 0.25 lb ai/acre Max 1.5 lb ai/acre/year 0.1 - 0.25 lb ai/acre Max 1.5 lb ai/acre/year 0.1 - 0.25 lb ai/acre Max 2 lb ai/acre/year 0.15 - 0.25 lb ai/acre Max 1.5 lb ai/acre/year
Almonds	4 ppb 3 ppb	No LOC exceedance	No LOC exceedance	No LOC exceedance	No LOC exceedance	Barley and cotton [2]	0.1 - 0.2 lb ai/acre Max 0.4 lb ai/acre/year 0.1-0.2 oz ai/ 1000ft Max 0.2 oz /acre/year or 0.172 lb ai/acre/year
			GENEEC				
Rice 0.25 lb (3) 0.7 lb	117 ppb 108 ppb	Exceeds Restricted Use and Endangered Species LOCs	Exceeds Restricted Use and Endangered Species LOCs	Exceeds Restricted Use and Endangered Species LOCs	Exceeds High Acute, Restricted Use, Chronic Risk LOCs	Wild Rice[3]	0.1-0.3 lb ai/acre Max 0.7 lb ai/acre/year

[1] In the original review, no assessment was made with estuarine species for these crops because those uses were not considered to result in significant estuarine or marine exposure. The risk conclusions presented here are based on screening level EECs compared to the toxicity of the appropriate estuarine organism. The results can be applied to new proposed use patterns that are similar to these crops and that are grown near estuaries.

[2] Use on barley and cotton is not expected to exceed any LOCs.

[3] The original modeling in the previous review, for rice, was with a modified GENEEC, designed for aquatic use sites like rice.