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MEMORANDUM

SUBJECT: Water Resource Assessment to Support Registration of Azoxystrobin (ICIA5504) Use on Grapes, Bananas, Tomatoes, Peanuts, Peaches, and Wheat.

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EFED has concluded the preliminary water resource assessment for azoxystrobin use on grapes, bananas, tomatoes, peanuts, peaches, and wheat. Monitoring data are not available at present, thus this assessment of potential ground and surface water exposure is based on screening models. The assessment focuses on two compounds, azoxystrobin and its acrylic acid degradate (Compound 2). Dietary exposure through drinking water is likely to be greatly limited because of azoxystrobin's limited use area and environmental fate properties. Using the Ground Water Interactive Concentration (GWIC) Screening Model developed in EFED, the maximum acute and chronic concentrations of azoxystrobin and its acrylic acid degradate (Compound 2) are not likely to exceed 0.1 and 3.8 $\mu$g/L, respectively. Tier 1 surface water modeling indicates the maximum acute and chronic concentrations of azoxystrobin are not likely to exceed 43 $\mu$g/L. The acrylic acid degradate of azoxystrobin (Compound 2) exhibit environmental fate properties of pesticides commonly detected in ground water, and is more likely to be found in ground water than azoxystrobin.

This assessment assumes that maximum acute and chronic concentrations in ground water and surface water are similar because of the environmental fate characteristics of azoxystrobin. The predominate routes of dissipation of azoxystrobin in soil (e.g., photodegradation and microbial-mediated degradation) are not expected to control azoxystrobin degradation in ground-water environments. In surface waters, photodegradation is expected to be an important route of dissipation in shallow, clear water bodies with a long hydrologic residence time. No data are available to assess the importance of microbial-mediated degradation in aquatic environments.

## Environmental Fate Assessment

Based on acceptable and supplemental environmental fate data, the dissipation of azoxystrobin (ICIA5504) appears to be predominately dependent on photodegradation[1] and to a lesser extent microbial-mediated degradation, and possible mobility in ground and surface waters. Although field dissipation studies did not confirm a high mobility and persistence of ICIA5504, ICIA5504 exhibited relatively low soil water partitioning coefficients ($K_d$ = 1.5 to 23) and moderate persistence ($t_{1/2}$ = 54 to 164 days) in laboratory studies. Transformation products of ICIA5504, Compounds 2, 28, and 30), exhibited low soil/binding affinity (or high mobility) and some persistence in laboratory and field studies. These data suggest ICIA5504 and its degradates may be transported to surface and ground waters under some use conditions (e.g. overspray or foliar wash-off on bare ground or soil incorporation in sandy soils). However, these conditions are expected to be controlled by foliar interception and photodegradative processes.

## Groundwater Assessment

EFED believes that azoxystrobin should not leach under most field conditions primarily because foliar interception and subsequent dissipation are expected to control azoxystrobin dissipation. Azoxystrobin leaching, however, may be possible with soil incorporation immediately posttreatment or soil conditions with little exposure to sunlight such as under a plant canopy in conjunction with coarse-textured soils. Even in these circumstances, the leaching potential of azoxystrobin will be limited.

Transformation products of azoxystrobin (Compounds 2, 28, and 30) exhibit mobility properties of pesticides found in ground water. In particular, Compound 2 exhibited persistence and mobility in laboratory and field studies. The leaching potential of Compound 2 is expected to be high because it will be an anion (negatively-charged species) under most environmental conditions.

Using the GWIC screening model, the concentrations of azoxystrobin and Compound 2 are not likely to exceed 0.1 and 3.8 µg/L, respectively. The Groundwater Ubiquity Score (GUS)

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[1] Although the laboratory fate data indicate ICIA5504degradation appears to be predominately dependent on photodegradation, EFGWB notes a clear degradation pattern of azoxystrobin in terrestrial and aquatic environments cannot be established because the base structure of ICIA5504 (i.e. cyanophenyl-pyrimidine-phenyl rings) was not readily degraded by abiotic and microbial-mediated processes. The degradation of ICIA5504 involved relatively minor molecular transformations of functional groups on the base structure.

indicates that azoxystrobin has low potential to leach into ground water (Table 3). Compound 2 has similar GUS scores to DCPA and atrazine, two herbicides found most frequently in ground water in proportion to their use. The high leaching index of Compound 2 can be attributed to a low soil sorption affinity and relatively high persistence in terrestrial environments. Since the proposed uses of azoxystrobin are limited to minor crops (except wheat), Compound 2 is not expected to pose a major ground water concern.

Uncertainties in the GWIC screening model are: 1) The screening model does not consider site specific factors regarding hydrology, soil properties, climatic conditions, and agronomic practices; 2.) The screening model does not account for volatilization; and 3.) Predicted ground water concentrations are linearly extrapolated from the application rates.

Table 1. Ranking of azoxystrobin leaching potential compared to pesticides with an extensive ground-water monitoring data base (Gustafson, 1989[2])

| Compound | t1/2 | log t1/2 | Koc | log Koc | GUS | Assumptions: | Type* | Impact Summary | Leacher? |
|---|---|---|---|---|---|---|---|---|---|
| **Benchmark pesticides:*** | | | | | | | | | |
| DCPA | 1000 | 3.00 | 47 | 1.67 | 6.98 | median | H | Very high where used | always |
| atrazine | 75 | 1.88 | 89 | 1.95 | 3.85 | median | H | Relatively high, high use | often |
| 2,4-D | 10 | 1.00 | 20 | 1.30 | 2.70 | median | H | Moderate, but high use | sometimes |
| alachlor | 17 | 1.23 | 180 | 2.26 | 2.15 | median | H | Moderate, but very high | sometimes |
| glyphosa | 25 | 1.40 | 5000 | 3.70 | 0.42 | median | H | Very low, high use. | rarely |
| triflura | 87 | 1.94 | 8000 | 3.90 | 0.19 | median | H | Very low, high use. | rarely |
| **Azoxystrobin residues:** | | | | | | | | | |
| azoxystr | 16 | 1.20 | 1590 | 3.20 | 0.96 | median | F | turf & grapes | rarely |
| azoxystr | 162 | 2.21 | 715 | 2.85 | 2.53 | worst | F | turf & grapes | sometimes |
| acrylic | 100 | 2.00 | 24 | 1.38 | 5.24 | worst (pH 8 soil) | F | turf & grapes | usually |
| acrylic | 25 | 1.40 | 68 | 1.83 | 3.03 | median | F | turf & grapes | often |

* These all happen to be herbicides because more data are available for herbicides, and herbicides are more often directly applied to soil in the spring, increasing the chance for leaching to occur. Because azoxystrobin is a fungicide which will generally contact foliage first, and is relatively immobile in soil, the median half-life value was taken from field studies (this value corresponded with soil photodegradation half

Since Compound 2 of azoxystrobin may potentially move into groundwater, EFED recommends the following label advisory:

" The active ingredient, azoxystrobin, in this product can be persistent for several months or longer. Azoxystrobin has degradation products which have properties similar to chemicals which are known to leach through soil to ground water under certain conditions as a result of agricultural use. Use of this

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2 Gustafson, D.I. 1989. Groundwater ubiquity score: A simple method for assessing pesticide leachability. Environmental Toxicology and Chemistry 4:339-357.

chemical in areas where soils are permeable, particularly where the water table is shallow, may result in ground water contamination."

**Surface Water Assessment**

EFED believes azoxystrobin and its transformation products can potentially contaminate surface waters through spray drift or surface water runoff. Since photodegradation is expected to be a major route of dissipation for foliar applied azoxystrobin, wash-off or direct over spray of azoxystrobin onto the soil surface will be required for transport in surface waters. Substantial fractions of azoxystrobin are expected to be available for runoff for several months ($t_{1/2}$= 49 to 164 days). It is moderately mobile ($K_d$= 1.5 to 23 ml/g) in most soil environments so runoff is expected to be primarily via dissolution in runoff water as opposed to adsorption on eroding soil. Since azoxystrobin is spray applied to turf and grapes, it also may be directly deposited into surface waters through spray drift. EFED assumes for ground spray that 1% of the application rate may be directly desposited into surface water. Transformation products of azoxystrobin (Compounds 2, 28, 30) are expected to be mobile in soil environments. In particular, Compound 2 exhibited relatively low soil/water partitioning coefficients ($K_d$=0.3 to 2.9 ml/g) and persistence in laboratory and field studies. Substantial fractions of Compound 2 are expected to be available for runoff via dissolution in runoff water for shorter time periods than parent azoxystrobin. The environmental fate data and usage data indicates azoxystrobin and it transformation products (specifically Compound 2) may move into surface waters.

The dissipation of azoxytstrobin in the surface waters should be predominately dependent on photodegradation ($t_{1/2}$= 11.1 to 17 days) and to a lesser extent microbial-mediated degradation ($t_{1/2}$= 54 to 164 days). Since photodegradation is a major route of degradation for azoxystrobin, the dissipation of azoxystrobin is expected to be dependent on physical components of the water (eg, sediment loading, etc.) affecting sunlight penetration. For example, azoxystrobin should not persist in clear shallow water bodies, but will probably be more persistent in unclear and/or deeper waters, particularly those with long hydrological residence times. The soil-water partitioning values indicate concentrations on suspended or bottom sediments should be higher then sediment pore water and water column. Sediment bound azoxystrobin can potentially desorb (assuming equilibrium conditions where $Kd_{ads}$=$Kd_{des}$) into the dissolved the water column. Dissolved azoxystrobin is not expected to bioaccumlate ($K_{ow}$= 316.22) in fish tissues. Sediment bound azoxystrobin is expected to be moderately persistent ($t_{1/2}$= 54 to 164 days) as suggested by persistence in aerobic and anaerobic soils.

The following data were used for input into the GENEEC modeling for **azoxystrobin**:

| Parameter | Value | Source |
|---|---|---|
| soil $K_{oc}$ | 210 ml/g* | MRID 43678178 |
| Aerobic soil half-life | 164 days | MRID 43678175 |
| Aerobic aquatic half-life | Stable | No available data |
| Photolysis Half-life (pH 7) | 14 days | MRID 43678173 |
| Hydrolysis (pH 7) | Stable | MRID 43678172 |
| Water Solubility | 6.7 mg/l | EFGWB One-Liner |

Uncertainties in the surface water assessment for azoxystrobin are associated with the following issues: 1.) the net impact of foliar dissipation for controlling the environmental fate of azoxystrobin, 2.) the spray drift potential of azoxystrobin; 3.) the adequacy of the $K_{oc}$ model to describe azoxystrobin partitioning in mineral soils; and 4.) the actual degradation rate of azoxystrobin and its transformation products in aquatic environments.

Tier 1 GENEEC modeling indicates the maximum surface water concentration of azoxystrobin ranges from 13 to 43 µg/L (Table 2). The maximum potential dietary exposure from surface water is likely not to exceed 43 µg/L. Since azoxystrobin is a new compound, monitoring data are not available to confirm surface water concentrations from actual use conditions.

Table 2. GENEEC EECs (µg/L) for Azoxystrobin Use on Grapes, Bananas, Tomatoes, Peanuts, Peaches, and Wheat

| Crops | Application Rate (lbs ai/A) | No. Applications | Application Interval (days) | Initial EEC (ppb) | 21-day-avg EEC (ppb) | 56-60-day avg. EEC (ppb) |
|---|---|---|---|---|---|---|
| Wheat | 0.2 | 2 | 10 | 13 | 12 | 11 |
| Tomatoes | 0.1 | 5 | 5 | 24 | 23 | 23 |
| Bananas | 0.135 | 8 | 12 | 29 | 28 | 26 |
| Peaches | 0.15 | 8 | 10 | 33 | 32 | 30 |
| Pecans | 0.20 | 6 | 14 | 33 | 32 | 30 |
| Peanuts | 0.40 | 2 | 30 | 24 | 23 | 22 |
| Grapes | 0.25 | 6 | 10 | 43 | 42 | 39 |