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UNIVERSITY OF ARKANSAS
DIVISION OF AGRICULTURE
Cooperative Extension Service

School of Agriculture, Fisheries & Human Sciences

Agriculture and Natural Resources

Asian Soybean Rust Fungicides and Aquatic Organisms

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Asian soybean rust is a NEW and potentially devastating disease for Arkansas and U.S. soybean production. On November 10, 2004, the disease was confirmed from two soybean fields in Louisiana and shortly thereafter in Mississippi, Florida, Georgia, Alabama, Arkansas, Missouri, South Carolina and Tennessee. The only effective control available will be fungicides, many labeled for emergency use under Section 18 labels (Table 2) by the Environmental Protection Agency.

Since soybean acres have not traditionally received widespread applications of fungicides, nor a wide variety of them, consequences to "off-target" species will not be fully known. While the fungicides currently available are generally considered to be safe, certain fungicides have warnings suggesting toxicity to fish and other aquatic organisms.

Arkansas is the second largest catfish producer in the U.S., the largest baitfish producer, with more than 6 billion fish sold each year, and leads the nation in the production of sportfish fingerlings and hybrid striped bass. Arkansas is ranked sixth overall in U.S. aquaculture production, and in recent years, crawfish, freshwater prawn and marine shrimp production has been established in the state. In addition, the many streams and rivers in the state are home to several endangered mollusk species.

Arkansas is also the ninth largest soybean-producing state in the country, and soybean production and aquaculture are both concentrated in the eastern Delta region. With the prospect of widespread fungicide use in soybeans and the close proximity of aquaculture production, streams and rivers, it is very important that fungicide applicators read and follow all labels with regard to environmental hazards and especially aquatic organisms.

All pesticide labels carry warnings and information on environmental hazards. These should be studied and adhered to closely. The label is the law, and it is the applicator's responsibility to fully follow the label.

A summary of the toxicity information for the currently labeled Asian soybean rust fungicides is provided in Table 1. This table is ***just a summary***, and the full labels and Material Data Safety Sheets (MSDS) for each product should be read before use. Labels and MSDS sheets can be obtained from the manufacturer, the pesticide dealer or on the Web

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(one recommended site is www.cdms.net, although there are numerous other sources available via the internet).

In general, the strobilurin (Headline, Quadris, part of Stratego, part of Quilt), triazole (Tilt, Propimax, Bumper, Domark, Folicur, Laredo, part of Stratego, part of Quilt) and chlorothalonil (Bravo, Echo, Equus) fungicides are considered moderately to highly toxic to fish and aquatic invertebrates (crawfish, shrimp, prawns, mollusks) under laboratory test conditions with direct exposure to the active ingredients. However, with the exception of Headline and the fungicides that contain chlorothalonil, labeled field use rates in soybeans would make it very difficult to reach the reported toxic level in a fish pond or other large body of water.

For example, Quadris contains 2.08 lb azoxystrobin per gallon. Applying this fungicide at the rate of 6.2 fl oz per acre directly to a pond would result in only 0.037 mg/L in the first acre-foot of water, well below the reported toxic level of 0.47 mg/L (trout) or 1.1 mg/L (bluegill). Triazoles like Tilt, Propimax, Bumper, Folicur or Domark are even less likely to injure aquatic organisms since their use rates are so low and the reported toxicity levels are correspondingly higher.

For example, Tilt contains 3.6 lb propiconazole per gallon. At the use rate of 4 fl oz per acre, a direct application would result in only 0.041 mg/L in the first acre-foot of water, well below the 3.2-6.4 mg/L concentration levels reported as toxic.

The exceptions to this, at present, are Headline and the chlorothalonil fungicides. Headline contains 2.09 lb per gallon of pyraclostrobin. At use rates of 6-12 fl oz per acre, a direct application of Headline to a pond would result in 0.036-0.072 mg/L pyraclostrobin in the first acre-foot of water, well above the reported toxicity levels of 0.0062-0.0114 mg/L for trout or bluegill. This scenario is similar for the fungicides that contain chlorothalonil. Applicators should use extra caution when applying fungicides that contain pyraclostrobin or chlorothalonil close to fish farms or other sensitive water sources.

Temperature, pH, organic matter and other factors in ponds and other bodies of water will likely reduce the effects of fungicides with respect to sensitive aquatic organisms. Nevertheless, care should be taken to avoid direct application, or drift, of any agricultural chemical into any body of water. FOLLOWING THE PESTICIDE LABEL AND ITS PRECAUTIONS IS THE BEST WAY TO AVOID PROBLEMS WITH NON-TARGET ORGANISMS.

Since actual toxicity to aquatic organisms in a more natural environment is poorly understood, Dr. Andrew Goodwin with the University of Arkansas Division of Agriculture Aquaculture Center for Excellence, located at the University of Arkansas at Pine Bluff, is conducting trials on the various Asian soybean rust fungicides to determine toxicity to important aquaculture species for Arkansas. This information will be released when available.

While we do not foresee problems using these fungicides in the state at this time, care in the use and application of any pesticide is always warranted – and mandated by the LABEL.

Table 1. Toxicities of fungicides for control of soybean rust to selected aquatic organisms.

Fungicide	Active Ingredient(s)	Amount A.I./Application	LC_{50} Fish	LC_{50} Daphnia	LC_{50} Algae
Quadris	Azoxystrobin	0.012 - 0.031 ppm	0.47 - 1.1 ppm	0.259 ppm	0.057 - 10 ppm
Headline	**Pyraclostrobin**	**0.012 - 0.018 ppm**	**0.0062 - 0.0114 ppm**	**0.0157 ppm**	0.152 ppm
Headline SBR	**Pyraclostrobin** + Tebuconazole	**0.016 ppm** 0.027 ppm	**0.0062 - 0.0114 ppm** 4.4 - 8.7 ppm	**0.0157 ppm** 11.8 ppm	0.152 ppm 1.64 - 7.1 ppm
Quilt	Azoxystrobin + Propiconazole	0.008 - 0.012 ppm 0.014 - 0.020 ppm	0.47 - 1.1 ppm 4.3 - 6.4 ppm	0.259 ppm 3.2 - 10.2 ppm	0.057 - 10 ppm
Stratego	Trifloxystrobin + Propiconazole	0.005 - 0.010 ppm 0.005 - 0.010 ppm	0.014 ppm 4.3 - 6.4 ppm	0.025 ppm 3.2 - 10.2 ppm	0.037 ppm
Folicur 3.6F	Tebuconazole	0.010 - 0.014 ppm	4.4 - 8.7 ppm	11.8 ppm	1.64 - 7.1 ppm
Tilt	Propiconazole	0.014 - 0.028 ppm	4.3 - 6.4 ppm	3.2 - 10.2 ppm	
Propimax	Propiconazole	0.014 - 0.028 ppm	4.3 - 6.4 ppm	3.2 - 10.2 ppm	
Bumper	Propiconazole	0.014 - 0.028 ppm	4.3 - 6.4 ppm	3.2 - 10.2 ppm	
Laredo EC	Mycobutanil	0.008 - 0.015 ppm	2.2 - 3.9 ppm	10.2 ppm	0.91 - 2.6 ppm
Laredo EW	Mycobutanil	0.008 - 0.015 ppm	2.2 - 3.9 ppm	10.2 ppm	0.91 - 2.6 ppm
Domark 230 ME	Tetraconazole	0.007 - 0.011 ppm	4.3 - 4.8 ppm	3.0 ppm	
Bravo WeatherStik	**Chlorothalonil**	**0.138 - 0.207 ppm**	**0.04 - 0.06 ppm**	**0.07 ppm**	**0.21 ppm**
Echo 720	**Chlorothalonil**	**0.138 - 0.230 ppm**	**0.04 - 0.06 ppm**	**0.07 ppm**	**0.21 ppm**
Equus 720 SST	**Chlorothalonil**	**0.138 - 0.230 ppm**	**0.04 - 0.06 ppm**	**0.07 ppm**	**0.21 ppm**
Equus DF	**Chlorothalonil**	**0.126 - 0.222 ppm**	**0.04 - 0.06 ppm**	**0.07 ppm**	**0.21 ppm**
Impact*	Flutriafol	0.007 ppm	61 - 77 ppm	67 - 78 ppm	12 ppm
Punch*	Flusilazole	0.013 ppm	1.2 - 1.7 ppm	3.4 ppm	6.4 ppm
Charisma*	Flusilazole + Famoxadone	0.008 ppm 0.007 ppm	1.2 - 1.7 ppm 0.011 - 0.013 ppm	3.4 ppm 0.0118 ppm	6.4 ppm 0.023 - 0.084 ppm
Caramba*	Metconazole	0.006 - 0.007 ppm	2.2 ppm	4.2 ppm	1.7 ppm
Operetta*	**Pyraclostrobin** + Metconazole	**0.007 - 0.009 ppm** 0.006 - 0.007 ppm	**0.0062 - 0.0114 ppm** 2.2 ppm	0.0157 ppm 4.2 ppm	0.152 ppm 1.7 ppm
Alto*	Cyproconazole	0.002 - 0.003 ppm	1.3 - 19 ppm	21 - 31 ppm	0.026 - 0.94 ppm
Quadris Extra*	Azoxystrobin + Cyproconazole	0.006 ppm 0.003 ppm	0.47 - 1.1 ppm 1.3 - 19 ppm	0.259 ppm 21 - 31 ppm	0.057 - 10 ppm 0.026 - 0.94 ppm
JAU6476*	Prothioconazole	0.011 - 0.013 ppm	4.02 ppm	2.9 ppm	12.7 ppm
Headline-Caramba Co-Pack*	**Pyraclostrobin** + Metconazole	**0.009 ppm** 0.005 ppm	**0.0062 - 0.0114 ppm** 2.2 ppm	0.0157 ppm 4.2 ppm	0.152 ppm 1.7 ppm

*The registrations for these products are pending, and they may or may not be available for use in 2005.

Source: Current Product Labels/MSDS Sheets (Section 3, Section 18).

To convert the LC_{50}/EC_{50} values (in mg/L) to pounds per acre-foot of water, simply multiply by 2.7. Example: If the LC_{50} for a particular product is 0.1 mg/L, the equivalent in pounds per acre-foot of water is 0.27 lbs (0.1 X 2.7 = 0.27).

All *amount of active ingredient per application* information was calculated for ponds with an average depth of three feet (three acre-feet).

Table 2. Fungicides approved as of 5/5/05 for control of soybean rust in Arkansas during 2005.

Product	Active Ingredient	Type of Label	Approved	Rate Range	Chemistry
Quadris	Azoxystrobin	Section 3 (Full)	Yes	6.2 - 15.4 fl oz/A	Strobilurin
Headline	Pyraclostrobin	Section 3 (Full)	Yes	6 - 9 fl oz	Strobilurin
Headline SBR	Pyraclostrobin + Tebuconazole	Section 18 (Emergency)	Yes	7.8 fl oz	Strobilurin + Triazole
Tilt	Propiconazole	Section 18 (Emergency)	Yes	4 - 8 fl oz	Triazole
Propimax	Propiconazole	Section 18 (Emergency)	Yes	4 - 8 fl oz	Triazole
Bumper	Propiconazole	Section 18 (Emergency)	Yes	4 - 8 fl oz	Triazole
Folicur, Orius	Tebuconazole	Section 18 (Emergency)	Yes	3 - 4 fl oz	Triazole
Laredo EC	Myclobutanil	Section 18 (Emergency)	Yes	4 - 8 fl oz	Triazole
Laredo EW	Myclobutanil	Section 18 (Emergency)	Yes	4.8 - 9.6 fl oz	Triazole
Stratego	Trifloxystrobin + Propiconazole	Section 18 (Emergency)	Yes	5.5 - 10 fl oz	Strobilurin + Triazole
Quilt	Azoxystrobin + Propiconazole	Section 18 (Emergency)	Yes	14 - 20 fl oz	Strobilurin + Triazole
Domark 230ME	Tetraconazole	Section 18 (Emergency)	Yes	4 - 6 fl oz	Triazole
The following are approved chlorothalonil products on soybeans that have soybean rust on their labels as of March 31, 2005. Chlorothalonil has some activity against soybean rust as a protectant but no systemic properties. Reports from other countries indicate it is used as a rotation product with the fungicides listed above, especially if the above are in short supply.					
Bravo WeatherStik	Chlorothalonil	Section 3 (Full)	Yes	1.5 - 2.25 pts/A	Chlorothalonil
Echo 720	Chlorothalonil	Section 3 (Full)	Yes	1.5 - 2.5 pts/A	Chlorothalonil
Equus 720 SST	Chlorothalonil	Section 3 Suppl.	Yes	1.5 - 2.5 pts/A	Chlorothalonil
Equus DF	Chlorothalonil	Section 3 Suppl.	Yes	1.25 - 2.2 lbs/A	Chlorothalonil

Read and follow all labels. The label is the law. Section 18 labels must be in possession of the applicator, and Section 18 pesticide applications must be reported to the Arkansas State Plant Board.

Many fungicides have restrictions on the labels regarding application, drift or runoff into streams, ponds or other aquatic environments or "sensitive" areas. Toxicity to fish, mollusks or other aquatic organisms is largely unknown in natural environments; however, some fungicides listed have been shown to be toxic to aquatic organisms under controlled laboratory experiments. Therefore, IT IS IMPERATIVE THAT ALL APPLICATORS READ LABELS CLOSELY AND USE ALL NECESSARY PRECAUTIONS.

Printed by University of Arkansas Cooperative Extension Service Printing Services.

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FSA7532-1M-10-05RV