OPP-2005-0242

++

Section 18 Quarantine Exemption Request For The Addition of Cyproconazole (Alto), Cyproconazole + Azoxystrobin (Quadris Xtra), Metconazole (Caramba), Metconazole + Pyraclostrobin co-pack (Headline-Caramba), Metconazole + Pyraclostrobin premix (Operetta), Flusilazole (Punch), Flusilazole + Famoxadone (Charisma), Prothioconazole (JAU6476), And Flutriafol (Impact)

to the 2003 submission for Propiconazole (Tilt, PropiMax, Bumper), Tebuconazole, (Folicur), Myclobutanil (Laredo EC, Laredo EW), Propiconazole + Trifloxystrobin (Stratego), Tetraconazole (Domark), Pyraclostrobin (Headline), Pyraclostrobin + Boscalid (Pristine), Azoxystrobin + Propiconazole (Quilt), And Tebuconazole + Pyraclostrobin (Headline SBR, Headline STAR)

Fungicides On Soybean For Control Of Australasian Soybean Rust (*Phakopsora pachyrhizi*)

Submitted by the
Minnesota Department of Agriculture
South Dakota Department of Agriculture

RECEIVED

OPP PUBLIC DOCKET

Contact Person and Qualified Expert (166.20(a)(1))

CONTACT PERSON:

Name: John C. Sierk
Title: Pesticide Regulatory Consultant
Organization: Minnesota Department of Agriculture
Address: 90 West Plato Blvd. St. Paul, MN 55107
Phone: (651) 296-4292
FAX: (651) 297-2271
E-Mail: john.sierk@state.mn.us

Name: Brad D. Berven
Title: Administrator
Organization: South Dakota Department of Agriculture
Address: 523 E. Capitol, Foss Building Pierre, SD 57501-3182
Phone: (605) 773-4432
FAX: (605) 773-3481
E-Mail: brad.berven@state.sd.us

QUALIFIED EXPERT:

Name: Martin A. Draper
Title: Extension Plant Pathologist
Organization: South Dakota State University
Address: Box 2108, PSB 113 Brookings, SD 57007
Phone: (605) 688-5157
FAX: (605) 688-4024
E-Mail: draper.marty@ces.sdstate.edu

See also list of members of Technical Science Working Group on Soybean Rust (**Appendix A, original submission**)

DESCRIPTION OF PESTICIDE REQUESTED (166.20 (a) (2))

Pesticides requested: Several products have emerged as potentially efficacious against Australasian soybean rust in international trials. No registrant has indicated the ability to meet the needs of the soybean industry,should an Australasian soybean rust epidemic occur in the US in 2003-2005. As such, we request that several products be considered for approval. Biological and economic considerations will be presented to support the use of additional products beyond those already labeled.

Limited efficacy data is currently available for any product against soybean rust. Pending the outcome of continuing comparative fungicide efficacy trials being conducted in Africa and South America under USDA, ARS direction, the following products are listed as candidates. While each state may make its own product decisions, depending on local conditions, it is suggested that several rather than one or two fungicides should be requested. This is considered important from several perspectives (biological and economic justifications).

Due to the large acreage potentially impacted, registrants have informed the states that no single product will be available in sufficient quantity to treat the potential land area impacted by soybean rust. See letters of support (**Appendix B – i through B – vi, original submission). Privately, some registrants have indicated that there are questions about the ability of the industry to meet the potential need of the US soybean industry if 40 million acres or more are in need of treatment. Production facilities have been geared up to 24/7 production for 48 weeks/year only allowing down time for plant maintenance. The addition of new chemistries allows for new production facilities to be brought on line to better address this need. Further, by bringing more combination products into use, a reduced rate of active ingredients often provides comparable control to the higher solo rates due to the apparent synergism between the modes of action and lessens potential environmental effects. Further, the loss of the strobilurin products as options in the early curative mode places increased demand on the triazole product supply. Scenarios could develop where there would be fields where no Section 3 labeled products would be applied and that decision could be the right one from label, resistance management, and disease control perspectives. Clearly adding more QoI chemistry is not going to solve the problem alone. By adding more products, the manufacture of the products is distributed and we have a better possibility of meeting needs while maintaining competition in the marketplace.**

Despite amendments previously filed for the inclusion of Azoxystrobin + Propiconazole (Quilt) and Pyraclostrobin + Tebuconazole (Headline SBR and Headline STAR), that represent reformulations of active ingredients already approved through Section 3 or previous Section 18 action, this submission represents the revised Section 18 petition alluded to in the initial request.

Propiconazole, the most widely available triazole, likely has the lowest degree of activity of the submitted triazoles. As more data has become available, it has become clear that other curative products with greater activity would be preferred to propiconazole. Three of the initially requested products are propiconazole and this relatively immobile triazole is a component in two of the premix products. In South America, propiconazole is only used in tank mixes and premixed formulations with more mobile products. In a shortage situation, propiconazole will be an acceptable product, but it would likely not be a first choice and in the long run it may not be a widely used active ingredient in the long run. Nonetheless, if applied correctly, propiconazole can provide adequate control or Asian soybean rust.

Registered products are listed in order of greatest potential for availability and preference for use.

Common Chemical Name (Active Ingredient): cyproconazole
Trade Names(s)And EPA Reg. No.: Alto®, no EPA Reg. Number
Formulation: 100SL
% Active Ingredient: 8.9% (0.83 lb/gal)
Technical Cyproconazole, EPA Reg. No. 100-864
Sentinel 40 WG Turf Fungicide, EPA Reg. No. 100-863
Manufacturer: Syngenta Crop Protection, Inc.; Greensboro, NC 27409

Common Chemical Name (Active Ingredient): cyproconazole + azoxystrobin
Trade Names(s)And EPA Reg. No.: Quadris Extra, no EPA Reg. Number
Formulation: 280SC
% Active Ingredient: 25.5% - 18.2% azoxystrobin + 7.3% cyproconazole (2.34lb ai/gal – 1.67 lb azoxystrobin ai/gal + 0.67 lb cyproconazole ai/gal)
Manufacturer: Syngenta Crop Protection, Inc.; Greensboro, NC 27409

Common Chemical Name (Active Ingredient): metconazole
Trade Names(s) And EPA Reg. No.: Caramba™, no EPA Reg. Number
Formulation: 90SL
% Active Ingredient: 8.6% ai by weight (0.75 lb/gal)
Manufacturer: BASF Corporation; Research Triangle Park, NC, 27709

Common Chemical Name (Active Ingredient): metconazole + pyraclostrobin
Trade Names(s) And EPA Reg. No.: Headline-Caramba co-pack, EPA Reg. No. 7969-186 (Headline)
Formulation: 90SL Caramba + 2.09EC Headline
% Active Ingredient: 8.6% (0.75 lb/gal) metconazole + 23.6% (2.09 lb/gal) pyraclostrobin
Manufacturer: BASF Corporation; Research Triangle Park, NC, 27709

Common Chemical Name (Active Ingredient): metconazole + pyraclostrobin
Trade Names(s) And EPA Reg. No.: Operetta™, no EPA Reg. Number
Formulation: 180EC (80 g/l metconazole + 100 g/l pyraclostrobin)
% Active Ingredient: 21.6% ai - 9.6% metconazole + 12% pyraclostrobin (0.67 lb metconazole/gal + 0. 83 lb pyraclostrobin/gal)
Manufacturer: BASF Corporation; Research Triangle Park, NC, 27709

Common Chemical Name (Active Ingredient): flusilazole
Trade Names(s) And EPA Reg. No.: Punch™, no EPA Reg. Number
Formulation: 3.3EC
% Active Ingredient: 37.8% (3.3 lb/gal)
Manufacturer: E. I. DuPont de Nemours and Company Delaware 19898

Common Chemical Name (Active Ingredient): flusilazole + famoxadone
Trade Names(s) And EPA Reg. No.: Charisma™, no EPA Reg. Number
Formulation: 1.7 EC
% Active Ingredient: 18.8% - 9.7% flusilazole + 9.1% famoxadone (1.7 lb ai/gal – 0.9 lb flusilazole + 0.8 lb famoxadone/gal)
Famoxadone Technical, EPA Reg. No. 352-605
Tanos (famoxadone), EPA Reg. No. 352-604
Manufacturer: E. I. DuPont de Nemours and Company Delaware 19898

Common Chemical Name (Active Ingredient): prothioconazole
Trade Names(s)And EPA Reg. No.: JAU 6476™, no EPA Reg. Number
Formulation: 480SC
% Active Ingredient: 41.0% prothioconazole (480 g/l=4 lb/gal)
Manufacturer: Bayer Corporation; Kansas City, MO 64120-0013

Common Chemical Name (Active Ingredient): flutriafol
Trade Names(s)And EPA Reg. No.: Impact™, no EPA Reg. Number
Formulation: 125SC
% Active Ingredient: 12.5% flutriafol (125 g/l=1.04 lb/gal)
Manufacturer: Cheminova; Wayne, NJ 07470

DESCRIPTION OF PROPOSED USE (166.20 (a)(3))

Sites to be Treated: Soybeans

Method of Application: Ground or Aerial

Rate of Application (cyproconazole): 0.28-0.42 oz a.i./A, 2.75-4 fluid ounces product per acre
Rate of Application (cyproconazole + azoxystrobin): 1.17 oz a.i./A (0.33 oz cyproconazole a.i. + 0.83 oz azoxystrobin a.i./A), 4 fluid ounces product per acre
Rate of Application (metconazole): 0.96-1.14 oz a.i./A, 8.2-9.6 fluid ounces product per acre
Rate of Application (metconazole + pyraclostrobin – as Headline-Caramba co-pack) 0.72 oz metconazole ai/A + 1.17 oz pyraclostrobin a.i./A, 6.08 fluid ounces metconazole + 3.56 fluid ounces pyraclostrobin product per acre
Rate of Application (metconazole + pyraclostrobin – as Operetta premix): 2.1-2.54 oz a.i./A (0.93-1.12 oz metconázole a.i./A + 1.17-1.34 oz pyraclostrobin a.i./A), 8.9-10.75 fluid ounces product per acre
Rate of Application (flusilazole): 1.65 oz a.i./A, 4 fluid ounces product per acre
Rate of Application (flusilazole + famoxadone): 1.91 oz a.i./A (1.01 oz flusilazole a.i./A + 0.9 oz famoxadone a.i./A), 9 fluid ounces product per acre
Rate of Application (prothioconazole): 1.42-1.75 oz a.i./A, 2.85-3.5 fluid ounces product per acre
Rate of Application (flutriafol): 0.91 oz a.i./A, 7 fluid ounces product per acre

Maximum Number of Applications: Maximum of two applications of Section 18 products. In some cases three to four total fungicide applications will be made. Other parts of the US may require three applications of Section 18 products under some situations.

Total Acreage to be Treated: 2 million acres of soybeans in South Dakota (represents ~50% of 4 million soybean acres potentially impacted, primarily in eastern South Dakota). At the current time, only about 15% of the soybean acres are treated with a fungicide, none of which is foliar application. All treated soybean acres in SD are currently treated with seed treatment products.

3.6 million acres of soybeans in Minnesota (represents ~50% of 7.2 million soybean acres potentially impacted, primarily in southern Minnesota).

36.9 million acres of soybeans in the United States (represents ~50% of 73.8 million soybean acres potentially impacted.

Australasian soybean rust models **(Appendix C, original submission)** suggest that most of the soybean acrés in the United States could be compromised by soybean rust at the point that the disease becomes established in the country. Unfortunately, at the current level of knowledge of this disease, there is no way of knowing with any degree of scientific certainty, what the risk of this disease will be in any specific location in advance of the epidemic. States where the epidemic originates may have a much higher percentage of their acreage impacted by the disease or treated to prevent infection.

In another scenario, the pathogen could be accidentally or purposely introduced into the Midwestern soybean production belt. In that scenario, the epidemiological dynamics of the pathogen's spread may be very different, depending on the site of the initial introduction. In accordance with the 2002 Agricultural Bioterrorism Protection Act, *Phakopsora pachyrhizi* has been identified as a biological agent with potential to pose a severe threat to plant health or plant products (Federal Register December 13, 2002 – 67:76908-76938 - http://www.aphis.usda.gov/vs/ncie/pdf/btarule.pdf) **(Appendix D, original submission).**

From November 10 to December 1, 2004, Phakopsora pachyrhizi was identified in nine southeastern states in the US. While it is unknown if the organism will overwinter in the US, this occurrence has shown that the pest will survive and cause disease in the US environment. As such, producers are prepared to treat with fungicides in 2005, should the disease recur. In SD and MN, treatment recommendations will be based on monitoring for the disease in our states as well as reports of the disease elsewhere in the US. Additionally, on February 23, 2005, Asian soybean rust was identified overwintering on kudzu near Dade City in Pasco County, Florida. As such, the likelihood of seeing soybean rust develop in the continental US in 2005 was dramatically increased.

Total Amount of Pesticide to be Used: Assuming 2 million acres of soybeans in South Dakota and 3.6 million acres in Minnesota (50% of soybean acreage in each state), the following scenario applies: (assumes that only one of the products used over the treated acreage – actual use may reflect a combination of products).

South Dakota

42,968-62,500 gal. of product or 35,664-51,874 lb a.i. of cyproconazole, or;
62,500 gal. of product or 146,250 lb a.i. of cyproconazole + azoxystrobin (41,874 lb a.i. cyproconazole + 104,374 lb a.i. pyraclostrobin), or;
128,124-150,000 gal of product or 96,092-112,500 lb a.i. of metconazole, or;
95,000 gal metconazole + 55,624 gal. of pyraclostrobin product or 71,250 lb a.i. of metconazole + 118,754 lb a.i. pyraclostrobin (co-pack), or;
139,062-167,788 gal. of product or 207,306-250,398 lb a.i. of metconazole + pyraclostrobin (premix) (92,136-111,288 lb a.i. metconazole + 115,170-139,110 lb a.i. pyraclostrobin), or;
62,500 gal. of product or 206,250 lb a.i. of flusilazole, or;
140,624 gal of product or 239,062 lb a.i. (112,500 lb a.i. fluzilazole + 126,562 lb a.i. famoxadone) of flusilazole + famoxadone, or;
44,530-54,686 gal. of product or 177,500-218,750 lb a.i. of prothioconazole
109,374 gal. of product or 113,750 lb a.i. of flutriafol

Minnesota

77,342-112,500 gal. of product or 64,195-93,373 lb a.i. of cyproconazole, or;
112,500 gal. of product or 263,250 lb a.i. of cyproconazole + azoxystrobin (75,373 lb a.i. cyproconazole + 187,873 lb a.i. pyraclostrobin), or;
230,623-270,000 gal of product or 172,965-202,500 lb a.i. of metconazole, or;
171,000 gal metconazole + 100,123 gal. of pyraclostrobin product or 128,250 lb a.i. of metconazole + 209,257 lb a.i. pyraclostrobin (co-pack), or;
250,312-302,342 gal. of product or 373,151-450,716 lb a.i. of metconazole + pyraclostrobin (premix) (165,845-200,318 lb a.i. metconazole + 207,306-250,398 lb a.i. pyraclostrobin), or;
112,500 gal. of product or 371,250 lb a.i. of fluzilazole, or;
253,123 gal of product or 430,311 lb a.i. (202,500 lb a.i. flusilazole + 227,812 lb a.i. famoxadone) of flusilazole + famoxadone, or;

80,154-98,434 gal. of product or 319,500-393,750 lb a.i. of prothioconazole
196,873 gal. of product or 204,750 lb a.i. of flutriafol

Among the requested products, cyproconazole (Alto) is a systemic, triazole fungicide with curative and protectant activity. It has post-infection activity that can stop pathogen establishment in the early phases of disease development. Cyproconazole can also exhibit anti-sporulant activity, reducing inoculum production and slowing disease progress. **This exemption request is for the use of one to two applications of cyproconazole (Alto) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management. **Use of cyproconazole on soybean would result in only 0.02-0.03 million lbs a.i. used per 1 million soybean acres treated.**

Cyproconazole + azoxystrobin (Quadris Xtra) is a premixed combination of two systemic products, a triazole fungicide (cyproconazole) that can be used as systemic eradicant and a protectant, and a strobilurin (azoxystrobin). While cyproconazole has post-infection activity that can stop pathogen establishment in the early phases of disease development and anti-sporulant activity, reducing inoculum production, this product premix should not be used as a curative. **This exemption request is for the use of one application of cyproconazole + azoxystrobin (Quadris Xtra) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. . **Use of cyproconazole + azoxystrobin on soybean would result in only 0.07 million lbs a.i. used if 1 million soybean acres were treated.**

Metconazole (Caramba) is a similar systemic, triazole fungicide that can be used as systemic eradicant and a protectant. It has post-infection activity that can stop pathogen establishment in the early phases of disease development. Myclobutanil is an anti-sporulant, reducing inoculum production, thereby slowing disease progress. **This exemption request is for the use of one to two applications of metconazole (Caramba) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of metconazole on soybean would result in only 0.05-0.06 million lbs a.i. used per 1 million soybean acres treated.**

Metconazole + pyraclostrobin premix (Headline-Caramba copack) is a prepackaged combination of two systemic products, a triazole fungicide (metconazole) that can be used as systemic eradicant and a protectant, and a strobilurin (pyraclostrobin). While metconazole has post-infection activity that can stop pathogen establishment in the early phases of disease development and anti-sporulant activity, reducing inoculum production, this product premix should not be used as a curative. **This exemption request is for the use of one application of metconazole + pyraclostrobin (Headline-Caramba copack) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of metconazole + pyraclostrobin on soybean would result in only 0.04 million lbs metconazole a.i. + 0.06 million lbs metconazole a.i. used if 1 million soybean acres were treated.**

Metconazole + pyraclostrobin (Operetta) is a premixed combination of these two fungicides. Pyraclostrobin is a systemic, strobilurin fungicide similar to azoxystrobin and trifloxystrobin that is a strong penetrant that can be used as systemic and protectant with curative activity. Nonetheless, strobilurins are not recommended for use as curatives. Metconazole (Caramba) is a systemic, triazole fungicide similar to propiconazole, tebuconazole, and myclobutanil that can be used as systemic eradicant and a protectant. It has post-infection activity that can stop pathogen establishment in the early phases of disease development. **This exemption request is for the use of one to two applications of metconazole + pyraclostrobin (Operetta) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of metconazole + pyraclostrobin on soybean would result in only 0.13 million lbs a.i. used per 1 million soybean acres treated.**

Fluzilazole (Punch) is a systemic, triazole fungicide similar to propiconazole, tebuconazole, and myclobutanil that can be used as systemic eradicant and a protectant. It has post-infection activity that can stop pathogen establishment in the early phases of disease development. **This exemption request is for the use of one to two applications of flusilazole (Punch) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of fluzilazole on soybean would result in only 0.0.10 million lbs a.i. used per 1 million soybean acres treated.**

Flusilazole + famoxadone premix (Charisma) is a prepackaged combination of two systemic products, a triazole fungicide (flusilazole) that can be used as systemic eradicant and a protectant, and a non-strobilurin QoI-Group 11 fungicide (famoxadone). While flusilazole has post-infection activity that can stop pathogen establishment in the early phases of disease development and anti-sporulant activity, reducing inoculum production, this product premix should not be used as a curative. **This exemption request is for the use of one or two applications of flusilazole + famoxadone (Charisma) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of flusilazole + famoxadone on soybean would result in only 0.12 million lbs a.i. used if 1 million soybean acres were treated.**

Prothioconazole (JAU 6476) is a systemic, triazole fungicide similar to propiconazole, tebuconazole, and myclobutanil that can be used as systemic eradicant and a protectant. It has post-infection activity that can stop pathogen establishment in the early phases of disease development. **This exemption request is for the use of one to two applications of prothioconazole (JAU 6476) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of prothioconazole on soybean would result in only 0.09-0.11 million lbs a.i. used per 1 million soybean acres treated.**

Flutriafol (Impact) is a systemic, triazole fungicide similar to propiconazole, tebuconazole, and myclobutanil that can be used as systemic eradicant and a protectant. It has post-infection activity that can stop pathogen establishment in the early phases of disease development. One report out of Brazil has indicated widespread movement in the soybean plant. **This exemption request is for the use of one to two applications of flutriafol (Impact) for control of Australasian soybean rust.** This disease organism is expected to attack the crop after canopy development and response to fungicides have required multiple applications for optimum disease management in other parts of the world. **Use of flutriafol on soybean would result in only 0.06 million lbs a.i. used per 1 million soybean acres treated.**

Under this exemption, only one of the listed products could be used for **one or two applications** in a given season. In combination with products that are already registered, control should be achieved where the following guidelines are followed:

Stage of Crop Growth When Treatment Will Be Made: **R-1 to R-6 (first flowering to full seed).**

Use Season: Immediately upon the introduction of Australasian soybean rust into the United States until September 15 of the final production year approved in this action.

Additional Restrictions, User Precautions & Requirements of Applicators: Apply products in a sufficient volume of water to ensure adequate coverage, consistent with product labeling, as follows:

Application Volume Recommendations for Soybean Rust Sec. 18 Fungicides

Product		Volume (gal)	
Active Ingredient (ai)	**Trade Name**	**Ground**	**Air**
cyproconazole	(Alto™)	Use sufficient water volume to provide thorough and uniform plant coverage. When using ground application, apply in a minimum of 10 gals./A (a minimum of 15 gals./A is recommended).	Use sufficient water volume to provide thorough and uniform plant coverage. When using aerial application, apply in a minimum of 5 gal./A.
cyproconazole + azoxystrobin	(Quadris Xtra™)	Use sufficient water volume to provide thorough and uniform plant coverage. When using ground application, apply in a minimum of 10 gals./A (a minimum of 15 gals./A is recommended).	Use sufficient water volume to provide thorough and uniform plant coverage. When using aerial application, apply in a minimum of 5 gal./A.
metconazole	(Caramba™)	Do not use less than 15 gpa spray volume by ground.	Do not use less 5 gpa spray volume by aerial application.
metconazole + pyraclostrobin	(Headline-Caramba copack)	Do not use less than 15 gpa spray volume by ground.	Do not use less 5 gpa spray volume by aerial application.
metconazole + pyraclostrobin	(Operetta™)	Do not use less than 15 gpa spray volume by ground.	Do not use less 5 gpa spray volume by aerial application.
flusilazole	(Punch™)	Apply with a minimum carrier volume of 10 gallons with conventional ground equipment, increasing volume as the plants mature to ensure thorough coverage – Use 10 gallons minimum with air-assisted sprayers	Apply in a minimum of 5 gallons by air
flusilazole + famoxadone	(Charisma™)	Apply with a minimum carrier volume of 10 gallons with conventional ground equipment, increasing volume as the plants mature to ensure thorough coverage – Use 10 gallons minimum with air-assisted sprayers	Apply in a minimum of 5 gallons by air
prothiocorlazole	(JAU6476™)	Apply in a minimum of 10 gallons by ground	Apply in a minimum of 5 gallons by air
flutriafol	(Impact™)	Apply in a minimum of 10 gallons by ground - provide thorough coverage of foliage	Apply in a minimum of 5 gallons by air - provide thorough coverage of foliage

Pursuant to South Dakota state law, all applicators applying these products must be certified.

ALTERNATIVE METHODS OF CONTROL (166.20(a)(4))

Registered Alternative Pesticides: azoxystrobin, chlorothalonil, thiophanate-methyl

See master submission for full description...

Group 11 fungicides, which include the strobilurin fungicides and famoxadone, fungicides with a **QoI** mode of action, are fungicides that act on the Quinone 'outside' binding site of the cytochrome bc1 complex (Quinone outside Inhibitors). Resistance to this mode of action has been widely documented in Europe where strobilurins have a longer use history. The most common resistance is a mutation at the G143A site of action and has been documented with *Alternaria solani* in the US; *Sphaerotheca fulginea* in Japan, Taiwan, and Spain; *Septoria tritici* in Ireland, UK, Germany, and France; *Venturia inaequalis* in Germany, Italy, and Poland;

Erysiphe tritici f. sp. *tritici* in UK, Germany, France, Belgium, Denmark, and Sweden; *Erysiphe tritici* f. sp. *hordei* in UK Scotland, Germany, Belgium and France, and; *Plasmopara viticola* in Japan and Taiwan. Recently a second mutation at L129L was identified in *Plasmopara viticola*. Additionally, metabolic resistance, sometimes called tolerance has been identified in *Venturia inaequalis*. To date, no cases of resistance have been identified in the wheat leaf rust pathogen (*Puccinia recondita*), perhaps the closest relative to *Phakopsora* that has been monitored. *Phakopsora pachyrhizi* exists in an asexual population, the sexual hosts of the fungus are not known to exist. However, in South America it is present in a mixed population of many strains, even though it was only introduced to the continent in 1999. This issue begs that question of whether there have been multiple cross-Atlantic introductions or if frequent mutations or parasexuality events that may have contributed to the development of variants and added to the diversity of the pathogen population. Until those questions are answered, resistance management should be among our utmost concerns.

Large economic losses due to Australasian soybean rust loom if the disease is allowed to progress unchecked. Losses in Brazil in 2002 exceeded 60% in some fields **(Appendix F, original submission)**. Under conditions of severe disease pressure, soybean producers need systemic products that are in good supply. Use of any fungicide product on soybeans has been very limited, because of lack of availability of suitable efficacious registered products to address real disease needs and infrequency of severe disease, and lack of serious disease that would be effectively controlled by fungicides.

Recent data generated in Brazil, indicates that triazole fungicides are quite effective against this pathogen. Triazole fungicides, have proven most consistent in providing curative control with the minimum acceptable risk of fungicide resistance and with superior economics to registered products **(see efficacy and economics sections)**. As a means of comparison, a one million acre figure will be used to consider use rates of each of the products requested. Use in specific states can be easily calculated from that figure.

To be proactive in managing resistance and deploying fungicide use to optimize efficacous control, a set of use guidelines has been suggested. These suggested use pattern have been through several revisions as more information comes available and will be published in March 2005 in an Extension publication with nationwide distribution titled, ***Using fungicides to manage Asian soybean rust*** (Dorrance, Draper, and Hershman, eds, Ohio State University Extension Service). The use guidelines from that publication are outlined below, with special reference to requested or approved products:

Suggested product use regimen: ***(modified from initial submission)*:**

- **If disease is expected, but not yet present (preventative):**

  LOW RISK – PRIOR TO DETECTION:

  Crop no earlier than beginning flowering (R1)* and no later than full seed (R6); based on reliable reports, the potential for soybean rust in your area is low risk and it has NOT been detected in nearby areas.

  - NO APPPLICATION FOR RUST CONTROL IS WARRANTED

- **If disease is expected, but not yet present (preventative):**

  HIGH RISK – PRIOR TO DETECTION: PREVENTATIVE TREATMENT

  Crop no earlier than beginning flowering (R1)* and no later than full seed (R6); based on reliable reports, the potential for soybean rust in your area is high risk, but it has NOT been detected locally.

  - Initial Treatment
    - Treat with ***chlorothalonil****; **-OR-**
    - ***strobilurin*** such as azoxystrobin (Quadris) or pyraclostrobin (Headline); **-OR-**
    - ***triazole*** such as propiconazole, tebuconazole, myclobutanil, tetraconazole, cyproconazole, metconazole, flusilazole, prothioconazole, or flutriafol; **-OR-**
    - ***premix or copack*** such as propiconazole + trifloxystrobin (Stratego), propiconazole + azoxystrobin (Quilt), tebuconazole + pyraclostrobin (Headline SBR/Headline STAR),

cyproconazole + azoxystrobin (Quadris Xtra), metconazole + pyraclostrobin (Headline-Caramba copack/Operetta), or flusilazole + famoxadone (Charisma).

- If a second application is needed,
  - Treat with a ***triazole*** such as propiconazole, tebuconazole, myclobutanil, tetraconazole, cyproconazole, metconazole, flusilazole, prothioconazole, or flutriafol; **-OR-**
  - ***Premix/copack*** such as propiconazole + trifloxystrobin (Stratego), propiconazole + azoxystrobin (Quilt), tebuconazole + pyraclostrobin (Headline SBR/Headline STAR), cyproconazole + azoxystrobin (Quadris Xtra), metconazole + pyraclostrobin (Headline-Caramba copack/Operetta), or flusilazole + famoxadone (Charisma), **-OR-**
  - ***strobilurin*** (if no other strobilurin has been applied – *no more than one solo strobilurin treatment should be applied*) such as azoxystrobin (Quadris) or pyraclostrobin (Headline).
  - Product chemistries should be rotated. If a strobilurin is used in the first application, it should be followed by a product with a different mode of action or a premix/copack/tank mix with multiple modes of action.
- If a third application is needed,
  - treat with a ***premix*** such as propiconazole + trifloxystrobin (Stratego – *due to a low rate of triazole, this product is best suited to preventative applications*), propiconazole + azoxystrobin (Quilt), or pyraclostrobin + boscalid (Pristine), + pyraclostrobin (Headline SBR/Headline STAR), cyproconazole + azoxystrobin (Quadris Xtra), metconazole + pyraclostrobin (Headline-Caramba copack/Operetta), or flusilazole + famoxadone (Charisma), **-OR-**
  - ***strobilurin*** (if no other strobilurin has been applied – *no more than one solo strobilurin treatment should be applied*) such as azoxystrobin (Quadris) or pyraclostrobin (Headline) **–OR-**
  - a ***triazole*** (propiconazole, tebuconazole, myclobutanil, tetraconazole, cyproconazole, metconazole, flusilazole, prothioconazole, or flutriafol) *if no other triazole has been applied.*

> **If disease is established on site (curative treatment):**

EARLY ESTABLISHMENT - CURATIVE TREATMENT

Crop no earlier than beginning flowering (R1)* and no later than full seed (R6); soybean rust is present at barely detectable levels in the lower to mid canopy in your fields or your neighbor's fields *(note: soybean rust will not respond to fungicides once the disease is well-established in a field)*:

- Initial Treatment
  - Treat with ***premix*** such as propiconazole + trifloxystrobin (Stratego – *due to a low rate of triazole, this product is best suited to preventative applications*), propiconazole + azoxystrobin (Quilt), tebuconazole + pyraclostrobin (Headline SBR/Headline STAR), cyproconazole + azoxystrobin (Quadris Xtra), metconazole + pyraclostrobin (Headline-Caramba copack/Operetta), or flusilazole + famoxadone (Charisma) – **OR -**
  - a ***triazole*** (propiconazole, tebuconazole, myclobutanil, tetraconazole, cyproconazole, metconazole, flusilazole, prothioconazole, or flutriafol).
- If a second application is needed,
  - Treat with ***premix*** such as propiconazole + trifloxystrobin (Stratego - *due to a low rate of triazole, this product is best suited to preventative applications*), propiconazole + azoxystrobin (Quilt), tebuconazole + pyraclostrobin (Headline SBR/Headline STAR), cyproconazole + azoxystrobin (Quadris Xtra), metconazole + pyraclostrobin (Headline-Caramba copack/Operetta), or flusilazole + famoxadone (Charisma) **- OR -**
  - a ***triazole*** (propiconazole, tebuconazole, myclobutanil, tetraconazole, cyproconazole, metconazole, flusilazole, prothioconazole, or flutriafol), **- OR –**
  - a ***strobilurin*** (if no other strobilurin has been applied) if curative treatment was effective and has eradicated disease (this condition is expected to be rare).
- If a third application is needed,
  - Treat with a ***premix*** such as propiconazole + trifloxystrobin (Stratego - *due to a low rate of triazole, this product is best suited to preventative applications*), propiconazole + azoxystrobin

(Quilt), tebuconazole + pyraclostrobin (Headline SBR/Headline STAR), cyproconazole + azoxystrobin (Quadris Xtra), metconazole + pyraclostrobin (Headline-Caramba copack/Operetta), or flusilazole + famoxadone (Charisma) **- OR -**

- a ***triazole*** (propiconazole, tebuconazole, myclobutanil, tetraconazole, cyproconazole, metconazole, flusilazole, prothioconazole, or flutriafol), ***-OR-***
- a ***strobilurin*** such as azoxystrobin (Quadris) or pyraclostrobin (Headline) ***ONLY*** *if no other strobilurin has been applied and if curative treatment was effective and has eradicated disease* (***this condition is expected to be rare***).

➢ **If disease is established on site (curative treatment):**

DISEASE ESTABLISHED – INCIDENCE (% of plants with any amount of disease) EXCEEDS 10-15% IN THE MID CANOPY:

Crop no earlier than beginning flowering (R1)* and no later than beginning seed (R6); based on reliable reports, soybean rust is present in your field and severity is high.

- NO APPLICATION RECOMMENDED FOR DISEASE CONTROL IN THIS FIELD – FUNGICIDES NOT EXPECTED TO PROVIDE ACCEPTABLE CONTROL OR ECONOMIC RESPONSE‡

*** Do not apply chlorothalonil if any active pustules are evident**

† Do not apply strobilurins solo if disease incidence exceeds 5%.

‡ Fungicides applied after disease incidence exceeds 10% in the mid canopy generally do not produce a satisfactory response in South American environments.

Data from some parts of the world suggest that fungicide applications made during the vegetative stages are sometimes beneficial. Most data, however, suggest that maximum benefit when using fungicides to manage soybean rust is achieved when sprays are applied between beginning flowering (R1) through full pod (R6). So far in the 2004-05 growing season in Brazil, only ~3% of the initial detections of soybean rust in the sentinel plot system have occurred in the vegetative stages while >75% have occurred at R4 or later (*n*=774 as of March, 2004).

A single fungicide application may be adequate for economical disease control if initial disease outbreak occurs late in the season, or where disease development is significantly slowed by an unfavorable environment. **Experience in South America suggests that a third application may be a rare occurrence except in areas where disease arrives early and flowering periods are long. If disease develops prior to the first application at R1, three treatments with a Section 18 product may be needed. Decisions on three applications should be based on disease levels in the field, rates of disease increase, and favorability of environment for disease development.**

As described in greater detail in the master submission, alternative control practices such as crop rotation, tillage, early planting, and use of resistant or more tolerant varieties are ineffective or insufficient for the management of this disease. Most cultural control methods will have little effect on a pathogen that will blow into northern states and may survive on alternative hosts in southern states. A severe soybean rust epidemic will cause considerable economic damage to an already weakened agricultural community in South Dakota, Minnesota and most soybean producing states.

A USDA soybean rust action plan discusses action to be taken to combat soybean rust **(Appendix G, original submission).**

EFFICACY OF USE PROPOSED UNDER SECTION 18 (166.20(a)(5))

Cyproconazole, metconazole, flusilazole, prothioconazole and *flutriafol* have post-infection activity which can stop pathogen establishment in the early stages of disease development. Each of these triazole products appear to have curative/eradicant/antisporulant activity. Triazole fungicides prevent the completion of the infection process by direct inhibition of sterol biosynthesis in the fungus. This mode of action (MOA) is known as FRAC group 3 or SBI (sterol biosynthesis inhibition) activity. These attributes allow an integrated pest management approach, using scouting, weather data, and application of only when conditions indicate it is warranted and disease risk is high.

While *metconazole, flusilazole, prothioconazole,* and *flutriafol* do not have US registrations, *cyproconazole* has been registered for use in the US, but is not currently available in a US marketed product.

The formulation of the above triazoles with a QoI (FRAC group 11) fungicide allows for two modes of action (MOAs) and often allows for lower effective rates of the active ingredients, extending product supplies. *Azoxystrobin* and *pyraclostrobin* currently have Section 3 labels for use on soybeans against soybean rust. *Famoxadone* has a Section 3 label for use on US agricultural crops, but not soybeans.

Efficacy of possible products against Australasian soybean rust on Soybeans (Conducted by USDA in Brazil and Paraguay, 2003)
No studies have been conducted in the United States because the pathogen has not yet been present during a cropping season. However, industry and USDA studies have been conducted in Brazil and Paraguay **(Appendix H, original submission)**. Following are summary data tables from the 2003-04 USDA studies in Paraguay, South America. Studies conducted by USDA offer some insight into product efficacy, but many of the products requested in this extended submission have not been studied adequately in USDA studies to offer yield responses. As such, in some cases only disease control data is available. It is assumed that since most products of similar chemistry provide comparable yield responses under similar disease control conditions, these products will also provide a comparable response.

- **Data supporting cyproconazole (Alto) and cyproconazole + azoxystrobin (Quadris Xtra)**

In the following three tables from USDA studies in Paraguay (2003-04), Priori Xtra (cyproconazole + azoxystrobin) was included as a local check. Priori Xtra is an identical formulation of the cyproconazole + azoxystrobin product Quadris Xtra that will be marketed in the US. At both Sato locations (Table 1, 2), cyproconazole + azoxystrobin was in the top group for disease suppression, yield, and 1000 seed weight. At the Yomo location in Paraguay (Table 3), cyproconazole + azoxystrobin was not significantly different from the top treatment for disease suppression, but was not among the best treatments for yield or 1000 seed weight.

Table 1. Summary of the final soybean rust severity (SBR), yield and 1000 seed weights for each the fungicides evaluated in the Sato 1 location in the 2003-04 Paraguay efficacy trials.

Fungicide Treatment						
Untreated Control (No fungicide)	34.2	A	957	C	116	G
Bravo 720 SC	25.6	B	953	C	125	CDEF
Eminent 125 SL (tetraconazole)	9.6	EF	954	C	131	ABCDEF
Domark 230ME (100 g ai/ha)	10.4	DEF	1023	BC	130	ABCDEF
Quadris 2.05 SC (6.2 oz/A)	12.1	DEF	1024	BC	138	A
Quilt 200 SE (20 oz./A) – R1	12.5	DEF	1032	BC	125	BCDEF
Systhane 20EW (100g ai/ha)	10.8	DEF	1054	BC	127	CDEF
Quilt 200 SE (14 oz/A)	12.9	DEF	1055	ABC	134	ABC
Echo 720	27.5	B	1055	ABC	125	BCDEF
Tilt 250 EC	13.8	CDEF	1110	ABC	133	ABCDEF
Endura + Penetrator	19.6	C	1121	ABC	124	EFG
Priori Xtra	7.9	F	1142	ABC	133	ABCDE
Domark 230 ME (100g ai/ha)-R3	10.0	DEF	1142	ABC	135	ABC
Dithane DF	26.3	B	1146	ABC	122	FG
Domark 230 ME (100g ai/ha)-R1	10.4	DEF	1148	ABC	134	ABC
Systhane 20EW 125g ai/ha	10.4	DEF	1148	ABC	131	ABCDE
Stratego 250 EC	10.8	DEF	1149	ABC	138	A
Domark 230 ME (85g ai/ha)	8.8	F	1154	ABC	135	ABC
Folicur 3.6 F	10.4	DEF	1165	ABC	133	ABCDE
Quilt 200SE(10.5 oz/A)- 3 app	12.9	DEF	1168	ABC	132	ABCDE
Stratego 1st app, Folicur 2nd & 3rd	11.3	DEF	1173	ABC	137	AB
Pristine (BAS 516F)	15.0	CDE	1220	ABC	135	ABC
Propimax EC (125g ai/ha)	13.3	DEF	1259	ABC	127	CDEF
Domark 230 ME (60g ai/ha)	12.5	DEF	1265	ABC	128	CDEF
Propimax EC (190g ai/ha)	12.1	DEF	1300	AB	127	CDEF
Headline (BAS 500F)	15.8	CD	1350	A	127	ABCD
Mean of 2 applications	**14.8**		**1129**		**130**	
Mean of 3 applications	**15.1**		**1131**		**130**	

Table 2. Summary of the final soybean rust severity (SBR), yield and 1000 seed weights for each the fungicides evaluated in the Sato 2 location in the 2003-04 Paraguay efficacy trials.

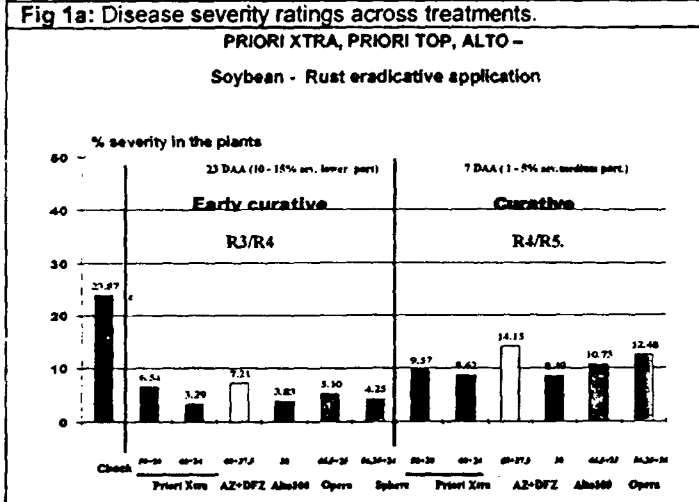
Untreated Control (No fungicide)	60.0	A	713	E	96	J
Bravo 720 SC	40.8	BC	981	ABCD	118	EFGH
Eminent 125 SL (tetraconazole)	14.2	I	1023	ABCD	129	AB
Domark 230ME (100 g ai/ha)	15.4	I	1088	BC	128	BC
Quadris 2.05 SC (6.2 oz/A)	39.6	BC	989	ABCD	114	GHI
Quilt 200 SE (20 oz./A) – R1	19.6	GHI	1019	ABCD	120	CDEFG
Systhane 20EW (100g ai/ha)	17.1	HI	1086	ABC	124	BCDEF
Quilt 200 SE (14 oz/A)	22.9	FGH	1124	AB	126	ABC
Echo 720	46.7	B	824	DE	108	I
Systhane 20EW (125 g ai/ha)	10.8	DEF	1054	BC	127	CDEF
Quilt 200SE (14 oz/A)	12.9	DEF	1068	ABC	134	ABC
Echo 720	27.5	B	1088	ABC	128	BCDEF
Tilt 250 EC	28.3	EF	942	ABCDEF	114	GHI
Endura + Penetrator	19.6	C	1121	ABC	124	EFG
Priori Xtra	15.8	HI	1137	AB	127	ABC
Domark 230 ME (100g ai/ha)-R3	16.6	HI	1042	ABCD	132	A
Dithane DF	43.8	B	946	ABCDEF	117	FGH
Domark 230 ME (100g ai/ha)-R1	18.8	HI	1055	ABCD	127	ABC
Systhane 20EW 125g ai/ha	180.3	HI	1063	ABCD	130	AB
Stratego 250 EC	27.5	F	975	ABCD	126	ABC
Domark 230 ME (85g ai/ha)	15.4	I	1088	AB	128	AB
Folicur 3.6 F	10.4	DEF	1165	ABC	133	ABCDE
Quilt 200SE(10.5 oz/A)- 3 app	22.5	FGH	916	BCDE	121	CDEFG
Stratego 1st app, Folicur 2nd & 3rd	26.3	FG	975	ABCD	125	ABCD
Pristine (BAS 516F)	35.0	CDE	1018	ABCD	118	DEFG
Propimax EC (125g ai/ha)	19.6	GHI	1108	AB	126	ABC
Domark 230 ME (60g ai/ha)	14.2	I	1073	ABC	124	BCDE
Propimax EC (190g ai/ha)	12.1	DEF	1300	AB	127	CDEF
Headline (BAS 500F)	29.2	DEF	1136	AB	128	AB
Mean of 2 applications	**26.9**		**1001**		**122**	
Mean of 3 applications	**27.4**		**1028**		**122**	

Table 3. Summary of the final soybean rust severity (SBR), yield and 1000 seed weights for each the fungicides evaluated in the Yomo location in the 2003-04 Paraguay efficacy trials.						
Fungicide Treatm[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Untreated Control (No fungicide)	5.0	BC	5304	CDEFG	159	ABC
Bravo 720 SC	5.8	BC	5439	CDEFG	130	C
Eminent 125 SL (tetraconazole)	4.2	C	5784	BCDEFG	191	A
Domark 230ME (100 g ai/ha)	5.8	BC	5360	CDEFG	170	ABC
Quadris 2.05 SC (6.2 oz/A)	5.0	BC	6650	ABCD	175	ABC
Quilt 200 SE (20 oz./A) – R1	6.7	AB	4899	EFG	138	BCD
Systhane 20EW (100g ai/ha)	6.7	AB	5390	CDEFG	148	ABC
Quilt 200SE (14 oz/A)	5.8	BC	7507	A	195	A
Echo 720	5.8	BC	6425	ABCDEF	150	ABC
Tilt 250 EC	5.0	BC	5304	CDEFG	159	ABC
Endura + Penetrator	5.8	BC	6463	ABCDEF	181	AB
Priori Xtra	5.0	BC	5071	G	128	D
Domark 230 ME (100g ai/ha)-R3	6.7	AB	5801	BCDEFG	169	ABC
Dithane DF'	5.8	BC	6330	ABCDEFG	167	ABC
Domark 230 ME (100g ai/ha)-R1	5.0	BC	4771	FG	128	D
Systhane 20EW 125g ai/ha	6.7	AB	4650	G	138	ABCD
Stratego 250 EC	5.0	BC	6477	ABCDE	158	ABC
Domark 230 ME (85g ai/ha)	5.8	BC	6719	ABCD	180	ABC
Folicur 3.6 F	5.0	BC	5386	CDEFG	133	BC
Quilt 200SE(10.5 oz/A)- 3 app	5.8	BC	5402	CDEFG	146	ABC
Stratego 1st app, Folicur 2nd & 3rd	5.0	BC	5504	BCDEFG	151	ABC
Pristine (BAS 516F)	5.0	BC	5773	BCDEFG	128	D
Propimax EC (125g ai/ha)	8.3	A	4781	FG	137	BCD
Domark 230 ME (115g ai/ha)	5.0	BC	6894	ABC	168	ABC
Propimax EC (190g ai/ha)	5.8	BC	4900	EFG	120	D
Headline (BAS 500F)	5.8	BC	7141	AB	197	A
Mean of 2 applications	**5.7**		**5762**		**154**	

- **Disease control data supporting cyproconazole and cyproconazole + azoxystrobin from Brazil (Syngenta).**

Fig 1: Cyproconazole (Alto), represented by the blue bars, and cyproconazole + azoxystrobin (Priori Xtra/Quadris Xtra) represented by the green (50+20 g ai/ha) and cyan (60+24 g ai/ha) bars show efficacious control of soybean rust under light disease pressure, 23.9% disease severity (Syngenta data).

Fig 1a: Disease severity ratings across treatments.



Trials. 06F306;06F307;15F312;15F313;18F326

Fig 1b: Disease evaluation as represented by disease control.

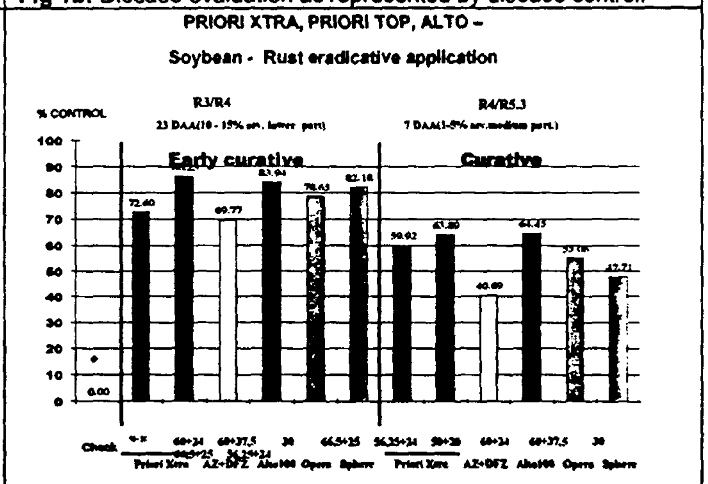


Fig 2: Cyproconazole (Alto), represented by the **blue bars**, and cyproconazole + azoxystrobin (Priori Xtra/Quadris Xtra) represented by the green (50+20 g ai/ha) and cyan (60+24 g ai/ha) bars show efficacious control of soybean rust under light disease pressure, 23.4% disease severity (Syngenta data). (Syngenta data).

Fig 2a: Disease severity ratings across treatments.

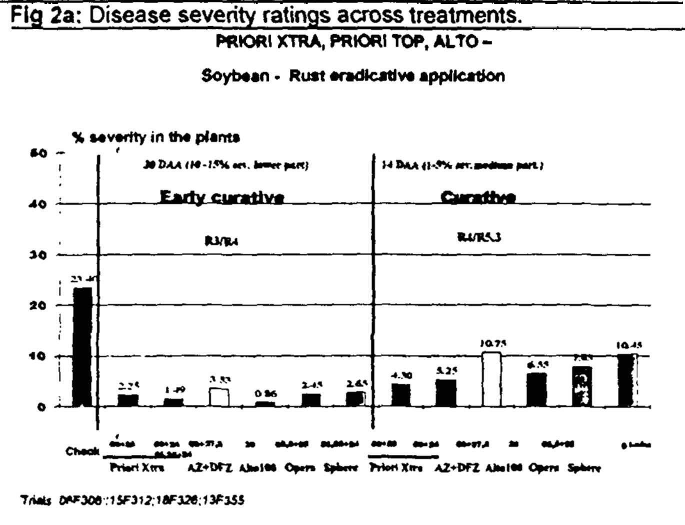


Fig 2b: Disease evaluation as represented by disease control.

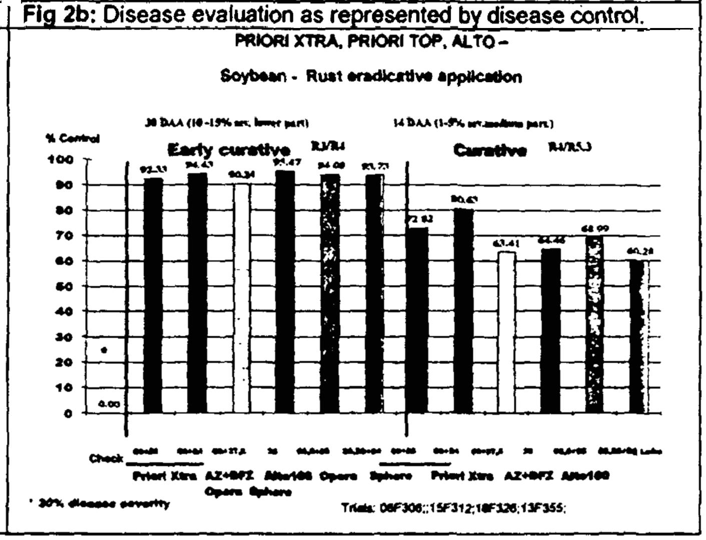


Fig 3. Cyproconazole (Alto), represented by the **blue bars**, and cyproconazole + azoxystrobin (Priori Xtra/Quadris Xtra) represented by the green (50+20 g ai/ha) and cyan (60+24 g ai/ha) bars show efficacious control of soybean rust under light disease pressure, 23.4% disease severity (Syngenta data). (Syngenta data).

Fig 3a. Disease severity ratings across treatments.

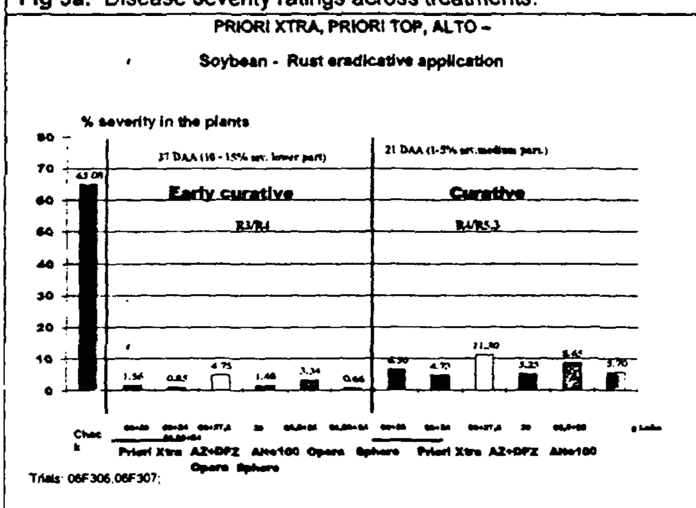
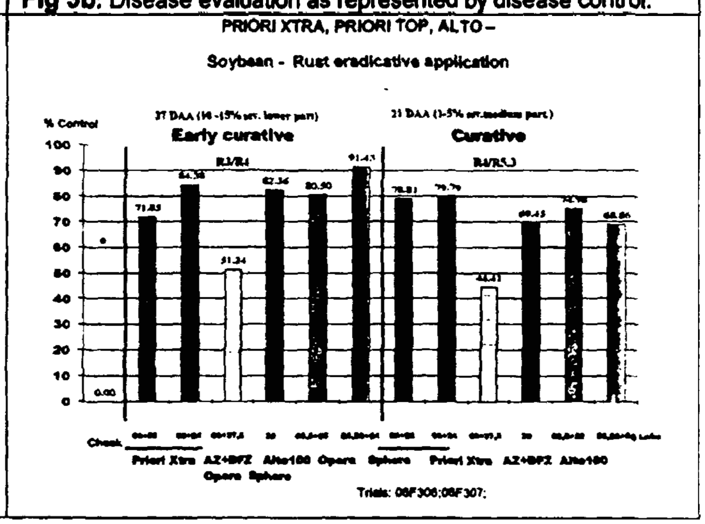


Fig 3b: Disease evaluation as represented by disease control.



While yield data for cyproconazole is lacking, in the studies above, cyproconazole (Alto) proved to be among the most efficacious products for disease control. This trend was true in early curative as well as later curative application scenarios. It is expected that a yield response will occur that would be similar to what is seen with other triazole fungicides since disease suppression with cyproconazole is similar to or numerically better than what is seen from other triazoles.

- **Support for metconazole (Caramba) and metconazole + pyraclostrobin (Headline-Caramba copack/Operetta).**

It can be seen in Tables 4 (below) that Opera (pyraclostrobin + epoxiconazole) is highly efficacious in controlling soybean rust and improving yield in the presence of soybean rust (Table 5). The triazole partner in Opera, epoxiconazole will not be requested in the US

Table 4. Opera Efficacy Summary 1- 2 applications

			Soybean Rust Severity %			
			BRB018	BRL019	BRL024	avg (n=3)
Treatment	Rate liter,kg/ha	g ai/ha	44 dalt	15 dalt	14 dalt	
Untreated			67.5 a	83.3 a	83.3 a	78.0
Opera/Opera	0.5	91.5	4.0 c	2.0 d	13.3 e	6.4
Stratego/Stratego	0.4	125	33.8 b	21.7 c	25.0 cd	26.8
Stratego/Folicur	0.4/0.3	125/75	28.8 b	6.0 d	20.0 de	18.3
Flint+Folicur/Flint+Folicur	0.1+0.5	50+125	5.8 c	6.3 d	33.3 b	15.1
Domark/Domark	0.5	50	15.0 c	-	-	
2 applications: first application/second application						
dalt=days after last treatment						
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)						
Stratego (trifloxystrobin + propiconazole, 187.5 + 125 g/l)						
Folicur 200 (tebuconazole, 200 g/l)						
Flint (trifloxystrobin, 500g/kg)						
Domark (tetraconazole, 100 g/l)						

Table 5. Opera Yield Summary 1 - 2 applications

			Yield kg/ha			
Treatment	Rate liter,kg/ha	g ai/ha	BRB018	BRL024	avg. (n=2)	
Untreated			1731	2341	2036	
Opera/Opera	0.5	91.5	2616	2698	2657	
Stratego/Stratego	0.4	125	1971	2636	2304	
Stratego/Folicur	0.4/0.3	125/75	2260	2562	2411	
Flint+Folicur/Flint+Folicur	0.1+0.5	50+125	2309	2539	2424	
Domark/Domark	0.5	50	2238	-		
		LSD (0.05)	180.21	222.22		
2 applications: first application/second application						
dalt=days after last treatment						
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)						
Stratego (trifloxystrobin + propiconazole, 187.5 + 125 g/l)						
Folicur (tebuconazole)						
Flint (trifloxystrobin, 500g/kg)						
Domark (tetraconazole, 100 g/l)						

Results from the trials below it is apparent that significant efficacy with pyraclostrobin based products is due the pyraclostrobin component (Table 6). In these trials Asian soybean rust control efficacy is compared among Opera (pyraclostrobin + epoxiconazole), Comet (pyraclostrobin), Folicur (tebuconazole) + Flint (trifloxystrobin), and Priori (azoxystrobin). A similar response was observed with yields (Table 7).

Table 6. Opera Efficacy Summary 2						
			Soybean Rust Severity %			
			1 App	1 App	2 App	
Treatment	Rate liter,kg/ha	g ai/ha	BRB019	BRB021	BRB020	avg (n=3)
			64 dat	44 dat	44 dat	
			% sev	% sev	% sev	
Untreated			70.0 a	66.7 a	66.7 a	67.8
Opera	0.5	91	5.0 c	16.7 a	2.3 d	8.0
Comet	0.26	65	9.7 c	26.7 d	8.3 cd	14.9
Folicur + Flint	0.5+0.1	100 + 50	12.3 c	28.3 d	7.7 cd	16.1
Priori	0.2	50	23.3 b	53.3 b	7.7 cd	28.1
dat=days after treatment						
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)						
Comet (pyraclostrobin, 250 g/l)						
Folicur (tebuconazole, 200 g/l)						
Flint (trifloxystrobin, 500g/kg)						
Priori (azoxystrobin, 250 g/l)						

Table 7. Opera Yield Summary 2						
			Yield kg/ha (by variety)			
Treatment	Rate liter,kg/ha	g ai/ha	BRB0190	BRB021	BRB020	avg (n=3)
Untreated			1599	1724	1777	1682
Opera	0.5	91	2503	2301	2479	2428
Comet	0.26	65	2303	2310	2385	2364
Folicur + Flint	0.5+0.1	100 + 50	2313	2260	2347	2306
Priori	0.2	50	2188	1991	2249	2143
		LSD (0.05)	317.47	156.83	165.55	
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)						
Comet (pyraclostrobin, 250 g/l)						
Folicur (tebuconazole, 200 g/l)						
Flint (trifloxystrobin, 500g/kg)						
Priori (azoxystrobin, 250 g/l)						
dat=days after treatment						

Caramba (metconazole) Efficacy

Caramba (metconazole) provided similar Asian soybean rust control compared to epoxiconazole in 6 field trials. One trial conducted in Mato Grosso, Brazil tested rates as low as 24-25 g ai/ha for both triazoles. There were no significant differences in disease control between metconazole and epoxiconazole at 31 days after treatment. Metconazole also demonstrated a very flat dose response between 24-48 g ai/ha (Table 8). This demonstrates the high level of biological efficacy for metconazole.

Table 8. Metconazole Efficacy for the Control of Soybean Rust in Mato Grosso, Brazil 2004					
BRL062					
			Soybean Rust Severity %		
Treatment	Rate liter/ha	g ai/ha	4/23/2003	5/3/2003	6/28/2003
			21 dat	31 dat	Yield kg/ha
Untreated			80.0 a	96.0 a	353
Caramba 60SL	0.4	24	25.0 ef	61.3 d	716
Caramba 60SL	0.6	36	25.0 ef	60.5 d	669
Caramba 60SL	0.8	48	22.0 f	59.8 d	726
Opus	0.2	25	20.5 fg	65.8 cd	733
Opus	0.4	50	17.5 g	66.3 cd	699
Comet	0.672	168	22.5 f	59.5 d	814
					LSD (0.05) 170
Variety: Jiripoca, planted Jan 10, 2003					
Trial had only 1 application made at early pod (4-2-2003), first sign of infection.					
Caramba 60SL (metconazole, 60 g/l)					
Opus (epoxiconazole, 125 g/l)					
Comet (pyraclostrobin, 250 g/l)					
dat=days after treatment					
Note: low yields due to late planting.					

Five other trials compare Caramba (metconazole) to Opus (epoxiconazole). Other products included for comparison were Opera, Systhane, and Stratego. There were no significant differences (p=0.05) between Caramba at 54 g ai/ha and Opus at 50 g ai/ha in any of the 5 trials. Caramba (54 G ai/ha), however, provided numerically better disease control than the competitive standards, Systhane and Stratego in all trials (significant in 2/5 trials) (Table 6). Consequently, excellent yield protection was provided by the Caramba treatments, similar to Opera (Table 7).

Table 9. Summary of Metconazole Efficacy for the Control of Soybean Rust in Brazil 2004

			Soybean Rust Severity %					
Treatment	Rate liter/ha	g ai/ha	BR6049	BR6037	BR6036	BR4041	BR4040	avg. (n=5)
			24 dat	32 dat	45 dat	31 dat	45 dat	
Untreated			40.0 a	26.7 a	36.7 a	100 a	91.7 a	59
Caramba	0.5 l	45	7.0 b	0.7 b	1.7 b	3.7 d	20.0 def	6.6
Caramba	0.6 l	54	10.0 b	0.3 b	1.7 b	0.8 f	20.0 def	6.6
Opera	0.5 l	91.5	11.7 b	1.0 b	2.0 b	1.3 f	25.0 de	8.2
Opera	0.6 l	110	11.7 b	0.3 b	1.7 b	0.8 f	20.0 def	6.9
Opus	0.3 l	37.5	12.0 b	0 b	1.7 b	1.3 f	25.0 de	8
Opus	0.4 l	50	9.3 b	0.7 b	2.3 b	0.4 f	20.0 def	6.5
Systhane	0.4 l	75	13.3 b	1.0 b	4.3 b	3.3 de	33.3 c	11
Stratego	0.4 l	125	15.0 b	2.3 b	6.7 b	7.7 b	46.7 b	15.7
Trials had only 1 application made at 1-3% of leaves infected.								
Caramba (metconazole, 90 g/l)								
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)								
Opus (epoxiconazole, 125 g/l)								
Systhane (myclobutanil, 250 g/l)								
Stratego (trifloxystrobin + propiconazole, 187.5 + 125 g/l)								
dat=days after treatment								

Table 10. Yield Summary of Metconazole Efficacy for the Control of Soybean Rust in Brazil 2004

			Yield kg/ha			
Treatment	Rate liter/ha	g ai/ha	BR6049	BR6037	BR4041	avg. (n=3)
Untreated			1926	1683	2519	2043
Caramba	0.5 l	45	2987	2258	3000	2748
Caramba	0.6 l	54	2987	2536	3028	2850
Opera	0.5 l	91.5	2828	2797	3019	2881
Opera	0.6 l	110	3087	2592	2972	2884
Opus	0.3 l	37.5	2431	2397	2936	2588
Opus	0.4 l	50	2680	2019	3019	2573
Systhane	0.4 l	75	2209	2333	2980	2507
Stratego	0.4 l	125	2222	2222	3000	2481
		LSD (0.05)	696	739	418	
Trials had only 1 application made at 1-3% of leaves infected.						
Caramba (metconazole, 90 g/l)						
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)						
Opus (epoxiconazole, 125 g/l)						
Systhane (myclobutanil, 250 g/l)						
Stratego (trifloxystrobin + propiconazole, 187.5 + 125 g/l)						

Pyraclostrobin + Metconazole Efficacy

Several mixtures of metconazole and pyraclostrobin were tested for rust control and compared to Opera under severe disease pressure in Mato Grosso, Brazil in 2003. Although the mixture containing 36 g ai/ha metconazole + 37.5 g ai/ha pyraclostrobin provided good disease control, optimal control was achieved with 36 g ai/ha metconazole + 66.5 g pyraclostrobin. Disease control and yield protection were equal to that of Opera (Table 7).

Table 10. Pyraclostrobin + Metconazole Efficacy for the Control of Soybean Rust in Matto Grosso, Brazil 2003

BRL063					
			Soybean Rust Severity %		
Treatment	Rate liter/ha	g ai/ha	4/23/2004	5/3/2003	6/28/2003
			21 dat	31 dat	Yield kg/ha
Untreated			77.5 a	92.5 a	411
Comet + Caramba	0.15 + 0.4	37.5 + 36	30.0 bc	58.3 bcd	941
Comet + Caramba	0.27 + 0.4	66.5 + 36	17.5 e	52.8 d	856
Opera	0.5	91.5	22.5 de	53.8 cd	990
Opera	0.6	110	20.0 e	52.5 d	874
					LSD (0.05) 202
Variety: Jiripoca, planted Jan 10, 2003					
Trial had only 1 application made at early pod (4-2-2003), at first sign of infection.					
Caramba (metconazole, 90 g/l)					
Comet (pyraclostrobin, 250 g/l)					
Opera (pyraclostrobin + epoxiconazole, 133 + 50 g/l)					
dat=days after treatment					
Note: low yiel s du to plan ng.					

Table 11. Treatments to Control *Phakopsora pachyrhizi* in Soybeans in Paraguay – Pirapo (Trial 2)[1].

Treatments	Rate (g a.i./ha)	Rust Severity[2] (%) 4/21/03 – 34 DAA[3]	Defoliation[2] (%) 4/21/03 – 34 DAA[3]	Yield (Kg/plot)[4]
Untreated	0	50.0 a	90.0 a	1.3
pyraclostrobin	50.0	15.0 e	60.0 e	1.58
trifloxystrobin	80.0	15.0 e	70.0 d	1.61
azoxystrobin	50.0	17.5 d	73.8 c	1.54
difenoconazole	75.0	30.0 b	80.0 b	1.65
metconazole	45.0	25.0 c	75.0 c	1.68
LSD (P=0.05)[5]				**0.32**

[1] BASF data
Evaluations recorded at 126-139 days after planting.
DAA= Days after application
[4] Yield from 6.4m² plots.
[5] Least Significant Difference @ 5% significance level

Cultivar: Nidera 9000
One application on Mar 18, 2003 at R3-R4
Spray volume 200 liters/hectare

Table 12. Treatments to Control *Phakopsora pachyrhizi* in Soybeans in Paraguay – Jesus[1].

Treatments	Rate (g a.i./ha)	Rust Severity[2] (%) 4/9/03 – 22 DAA[3]	Defoliation[2] (%) 4/9/03 – 22 DAA[3]	Yield (Kg/plot)[4]
Untreated	0	52.5 a	90.0 a	1.77
pyraclostrobin	50.0	20.0 b	52.5 f	2.12
trifloxystrobin	80.0	27.5 b	57.5 e	2.08
azoxystrobin	50.0	28.8 b	65.0 de	2.13
difenoconazole	75.0	37.5 b	77.5 bc	1.91
metconazole	45.0	31.3 b	72.5 cd	2.05
LSD (P=0.05)[5]				**0.33**

[1] BASF data
[2] Evaluations recorded at 126-139 days after planting.
[3] DAA= Days after application
[4] Yield from $6.4m^2$ plots.
[5] Least Significant Difference @ 5% significance level

Cultivar: Nidera 8000
One application on Feb 15, 2003 at R3-R4
Spray volume 200 liters/hectare

Table 13. Treatments to Control *Phakopsora pachyrhizi* in Soybeans in Paraguay – Jesus (Trial 2)[1].

Treatments	Rate (g a.i./ha)	Rust Severity[2] (%) 4/9/03 – 19 DAA[3]	Defoliation[2] (%) 4/9/03 – 19 DAA[3]	Yield (Kg/plot)[4]
Untreated	0	40.0 a	90.0 a	1.52
pyraclostrobin	50.0	13.8 f	60.0 f	2.16
trifloxystrobin	80.0	18.0 e	62.5 e	1.88
azoxystrobin	50.0	21.3 d	67.5 d	1.91
difenoconazole	75.0	26.3 c	80.0 b	1.73
metconazole	45.0	25.0 c	73.8 c	1.68
LSD (P=0.05)[5]				**0.28**

[1] BASF data
[2] Evaluations recorded at 126-139 days after planting.
[3] DAA= Days after application
[4] Yield from $6.4m^2$ plots.
[5] Least Significant Difference @ 5% significance level

Cultivar: RR 8.2
One application on Feb 18, 2003 at R3-R4
Spray volume 200 liters/hectare

Table 14. Treatments to Control *Phakopsora pachyrhizi* in Soybeans in Brazil – Sorriso[1].

Treatments	Rate (g a.i./ha)		Defoliation[2] (%) 4/23/03 – 13 DAA[3]	Yield (Kg/plot)
Untreated	0		97.0	N/A
epoxiconazole	25.0		55.0	N/A
difenoconazole	62.5		70.0	N/A
metconazole	54.0		65.0	N/A
pyraclostrobin	75.0		65.0	N/A

[1] BASF trial
[2] Evaluations recorded at 126-139 days after planting.
[3] DAA= Days after application

Cultivar: M-Soy 8400
One application at R5.5 (curative treatment)
Spray volume 150 liters/hectare

❖ **Support for flusilazole (Punch) and flusilazole + famoxadone (Charisma).**

It can be seen in Fig 4, 5, 6, and 7 (below) that Punch (flusilazole) is highly efficacious in controlling soybean rust and improving yield in the presence of soybean rust. Yield data is not available. The addition of the non-strobilurin QoI fungicide famoxadone also resulted in excellent control, comparable to Folicur in one study (Fig 8) and Opera (Fig 9).

Fig 4. Fungicide efficacy of flusilazole for the control of Asian soybean rust. Ponta Grosso, Parana, Brazil, 2004. Evaluations were 21 days after treatment ML FP/ha=milliliters of formulated product/hectare.

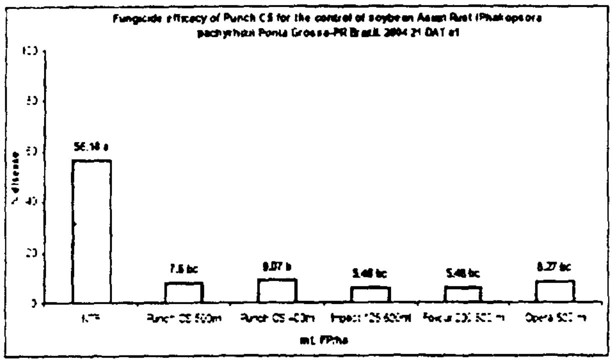


Fig 5. Fungicide efficacy of flusilazole for the control of Asian soybean rust. Rondnopolis, Mato Grosso, Brazil, 2003. Evaluations were 21 days after treatment ML FP/ha=milliliters of formulated product/hectare.

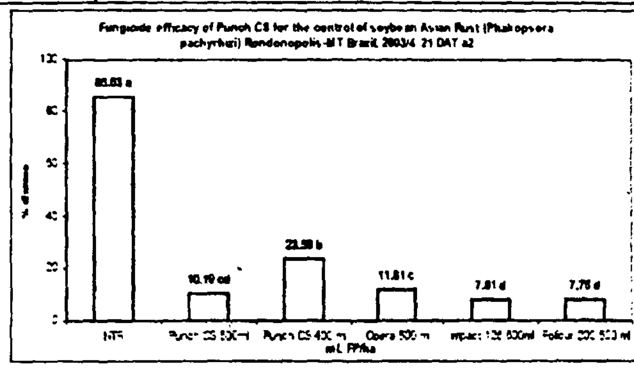


Fig 6. Fungicide efficacy of flusilazole for the control of Asian soybean rust. Rondnopolis, Mato Grosso, Brazil, 2003. Evaluations were 21 days after treatment ML FP/ha=milliliters of formulated product/hectare.

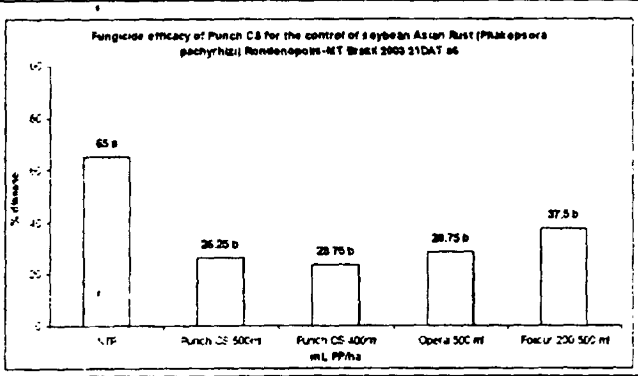


Fig 7. Fungicide efficacy of flusilazole for the control of Asian soybean rust. Alto Garcias, Parana, Brazil, 2003. Evaluations were 29 days after treatment ML FP/ha=milliliters of formulated product/hectare.

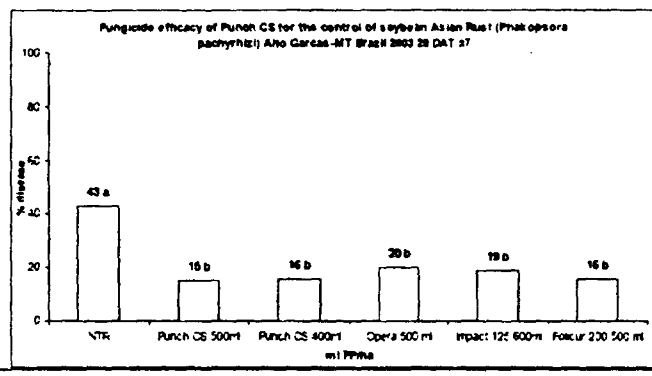


Fig 8. Fungicide efficacy of flusilazole+famoxadone for the control of Asian soybean rust. Londrina, Parana, Brazil, 2004. Evaluations were 36 days after treatment ML FP/ha=milliliters of formulated product/hectare.

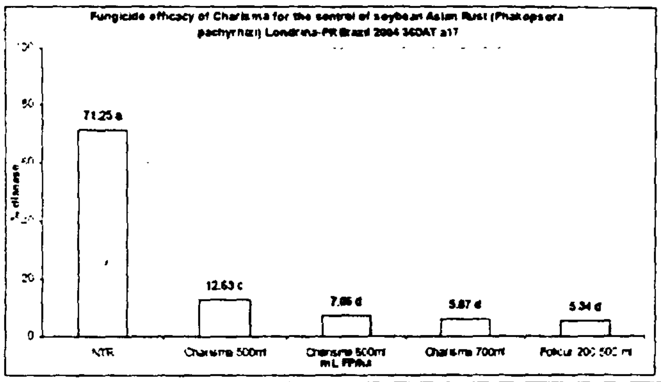
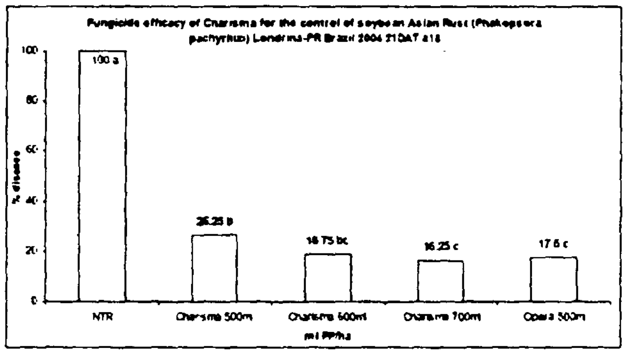


Fig 9. Fungicide efficacy of flusilazole+famoxadone for the control of Asian soybean rust. Londrina, Parana, Brazil, 2004. Evaluations were 21 days after treatment ML FP/ha=milliliters of formulated product/hectare.



The data above were supplied by the registrant. No known independent trials were available. Additional company generated data in support of the efficacy of fluzilazole and fluzilazole + famoxadone can be found in **Appendix 1, this addendum.**

Support for prothioconazole (JAU 6476).

It can be seen in Fig 10 that prothioconazole (JAU6476) performed similarly to tebuconazole in side-by-side comparisons where initial disease was less than 5% at initial treatment. Prothioconazole is in further testing in South America in 2004-05. In Fig 11, prothioconazole also performed similar to Folicur when initial application occurred later in disease development.

Prothioconazole was also tested in the USDA trials in Paraguay in 2002-03. In Table 15, prothioconazole performed similarly to other triazoles such as tebuconazole (Folicur) and myclobutanil (Laredo) for disease control and 1000 seed weight (Table 16), yield and defoliation (Table 17).

Fig 10. Bayer data supplied in support of prothioconazole in preventative mode. Initial disease was less than 5% at initial treatment.

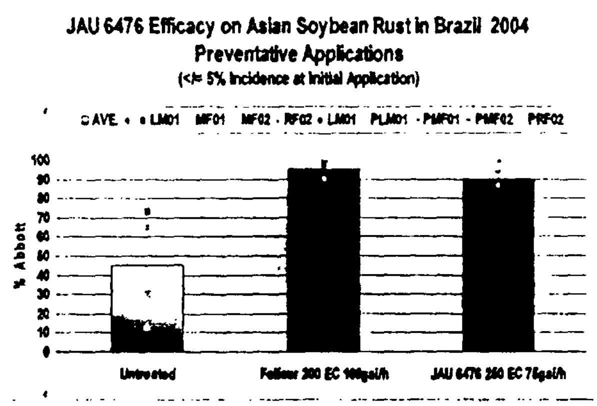


Fig 11. Bayer data supplied in support of prothioconazole in post infection or "curative" mode. Initial disease in the range of 15-30% at initial treatment.

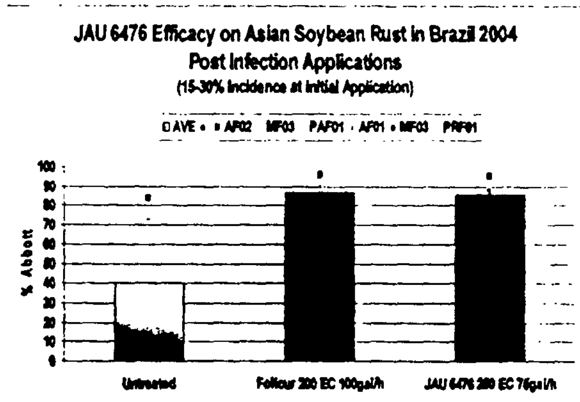


Table 15. Mean rust severity (%) at growth stage R6 in each fungicide treatment from the three locations of the fungicide efficacy trial located in Paraguay during the 2002-2003 growing season (USDA data).

Fungicide treatment (ai)[1]	Sato[2] Rust severity (%)	Sato[2] Rank within location	TRP[2] Rust severity (%)	TRP[2] Rank within location	Yasu[2] Rust severity (%)	Yasu[2] Rank within location	Mean rust severity
BAS 500 00F (pyraclostrobin)	0.7	20	4.1	20	1.6	13	2.1
Stratego 250EC (trifloxystrobin + propiconazole)	2.6	18	6.5	19	1.2	14	3.4
Echo 720 (chlorothalonil)	2.8	17	8.0	18	1.6	12	4.1
Domark 125SL (tetraconazole)	10.1	7	8.3	16	0.8	19	6.4
Quadris -9 oz/A (azoxystrobin)	2.6	19	8.3	17	5.5	9	5.5
Quadris -6 oz/A (azoxystrobin)	3.2	16	8.5	15	12.7	4	8.1
BAS 516 UDF (pyraclostrobin + boscalid)	4.1	15	9.0	14	2.8	10	5.3
AMS 21619 480SC (prothioconazole)	6.0	12	9.3	13	0.9	15	5.4
Dithane DF (mancozeb)	9.8	8	9.9	12	11.7	6	10.4
Laredo 2 EC (myclobutanil)	8.1	10	9.9	11	0.9	16	6.3
Bravo (chlorothalonil)	7.3	11	10.2	10	14.7	2	10.7
Enable 2F -100g ai/ha (fenbuconazole)	9.3	9	10.2	9	0.8	18	6.8
Enable 2F -75g ai/ha (fenbuconazole)	14.6	2	10.5	8	0.9	17	8.6
BAS 510 (boscalid)	14.0	3	11.0	7	7.7	8	10.9
Folicur 3.6F (tebuconazole)	5.5	14	11.5	6	0.6	20	5.9
Systhane 20EW (myclobutanil)	5.6	13	12.0	5	1.9	11	6.5
Tilt (propiconazole)	10.3	6	14.1	4	12.6	5	12.3
Propimax EC (propiconazole)	13.1	5	14.7	3	9.8	7	12.5
Moncut (flutolanil)	13.4	4	15.7	2	14.5	3	14.5
Untreated control	27.6	1	26.9	1	25.6	1	26.7
Location mean[2]	6.4	A	10.9	B	6.4	A	
Mean of 2 applications[3]	10.4	AB	11.6	A	6.7	C	
Mean of 3 applications[3]	6.7	C	10.2	B	6.2	C	
Mean yield at each location, (Kg/ha @13%)[2]	2023.2	B	1655.8	C	3730.6	A	

[1] All fungicide treatments significantly different from control (P=0.05).
[2] Differences between locations significant at (p=0.001), means with different letter were significantly different. There was a significant location by treatment interaction (p=0.0001) seen as differences in ranking within each location.
[3] Significant (p=0.05) location by number of applications interaction.

Table 16. Mean 1000 seed weights of each fungicide treatment from the three locations of the fungicide efficacy trial done in Paraguay during the 2002-2003 season (USDA data).

Fungicide treatment (ai)	Sato[1]			TRP[1]			Yasu[1]				
	1000 seed wt (g) at 13%	Rank within location		1000 seed wt (g) at 13%	Rank within location		1000 seed wt (g) at 13%	Rank within location		Treatment mean	
BAS 500 00F (pyraclostrobin)	162.4	1		147.3	1		167.1	7	*	158.9	
AMS 21619 480SC (prothioconazole)	160.9	2		146.4	3		162.4	19	*	156.5	
Echo 720 (chlorothalonil)	160.6	3		144.9	6		165.3	12	*	156.9	
Stratego 250EC (trifloxystrobin + propaconazole)	160.4	4		137.4	15	*	166.5	10	*	154.8	*
Quadris -9 oz/A (azoxystrobin)	159.3	5		144.3	7		168.4	3	*	155.6	*
Quadris -6 oz/A (azoxystrobin)	158.9	6		140.4	10		167.5	5	*	157.3	
Dithane DF (mancozeb)	158.1	7		142.9	8		167.0	8	*	156.0	*
BAS 516 UDF (pyraclostrobin + boscalid)	158.0	8		141.5	9		169.6	2	*	156.4	*
Folicur 3.6F (tebuconazole)	157.6	9		146.0	4		171.1	1	*	158.3	
Tilt (propaconazole)	157.5	10		136.0	18	*	167.4	6	*	153.6	*
Domark 125SL (tetraconazole)	157.5	11		139.0	13	*	164.8	16	*	153.8	*
Bravo (chlorothalonil)	156.5	12		139.0	14	*	168.1	4	*	154.5	*
Systhane 20EW (propaconazole)	156.3	13		145.4	5		165.0	14	*	155.5	*
Enable 2F (75g ai/ha) (propaconazole)	156.0	14		137.1	16	*	165.1	13	*	152.8	*
Enable 2F (100g ai/ha) (propaconazole)	156.0	15		146.9	2		166.9	9	*	156.6	
Laredo 2 EC (propaconazole)	154.6	16	*	139.9	12	*	165.0	15	*	153.2	*
Propimax EC (propaconazole)	153.9	17	*	134.5	19	*	164.6	17	*	151.0	*
BAS 510 (boscalid)	152.4	18	*	140.4	11		163.9	18	*	152.2	*
Moncut (flutolanil)	149.3	19	*	136.8	17	*	161.8	20	*	149.3	*
Untreated control	148.5	20	*	133.5	20	*	165.8	11	*	149.3	*
Location mean[2]	156.7 B			141.0 C			166.2 A				
Mean yield at each location, (Kg/ha @13%)[2]	2023 B			1656 C			3731 A				

[1]Significant differences among treatments within each location, (*) indicates treatments not significantly different from the control within the location. There was a significant treatment by location interaction (p=0.1).
[2]Differences among means were significant (p=0.05), means with different letters differed significantly.

Table 17. Mean yield and percent defoliation of soybean plots treated with twenty fungicide treatments at three locations in Paraguay during the 2002-2003 growing season (USDA data).

Fungicide Treatment (ai)	Yield (K/Ha) at 13% Moisture[1]					Defoliation[2] (%) at Sato							
						Mean		Two App's		Rank	Three App's		Rank
Folicur 3.6F (tebuconazole)	2703	A				86	A	80.0		8	91.3	A	19
BAS 516 UDF (pyraclostrobin + boscalid)	2671	A	B			77		80.0		6	73.8		3
Stratego 250EC (trifloxystrobin + propiconazole)	2581	A	B	C		78		70.0		1	86.3	A	13
BAS 500,00F (pyraclostrobin)	2551	A	B	C		73		71.3		2	73.8		2
AMS 21619 480SC (prothioconazole)	2545	A	B	C		85		90.0	A	15	80.0		7
Dithane DF (mancozeb)	2514	A	B	C	D	74		71.3		3	77.5		6
Enable 2F,100g ai/ha (fenbuconazole)	2513	A	B	C	D	81		85.0	A	11	75.0		4
Echo 720, (chlorothalonil)	2510	A	B	C	D	81		80.0		7	81.3		8
Quadris, 9 oz/A (azoxystrobin)	2502	A	B	C	D	79		71.3		4	86.3	A	14
Quadris, 6 oz/A (azoxystrobin)	2448		B	C	D	81		81.3		9	81.3		9
Enable 2F,75g ai/ha (fenbuconazole)	2446		B	C	D	80		76.3		5	86.3	A	15
Bravo (chlorothalonil)	2417			C	D	81		86.3	A	12	76.3		5
BAS 510 (boscalid)	2396			C	D	91	A	92.5	A	20	88.8	A	17
Moncut (flutolanil)	2395			C	D	86	A	90.0	A	16	81.3		10
Propimax EC (propiconazole)	2391			C	D	80		90.0	A	17	70.0		1
Tilt (propiconazole)	2389			C	D	88	A	90.0	A	18	86.3	A	16
Systhane 20EW (myclobutanil)	2387			C	D	82		81.3		10	82.5		11
Untreated control	2383			C	D	93	A	91.3	A	19	94.3	A	20
Laredo 2 EC (myclobutanil)	2366			C	D	88	A	87.5	A	14	89.3	A	18
Domark 125SL, (tetraconazole)	2288				D	84		86.3	A	13	82.5		12
Mean of two applications	2469							82.6					
Mean of three applications	2470										82.2		

[1]Mean of two application schedules at three locations, four replications per location. No significant location or application interactions.
[2]Mean of four replications from the Sato location. Significant treatment by application schedule interaction seen.
[3]Means separated using LSD, means with same letter are statistically the same.

❖ **Support for flutriafol (Impact).**

Data has been generated from trials where flutriafol has been included as a local comparison.

Independent trial measuring the efficacy of myclobutanil on Australasian soybean rust (Conducted in Brazil by the FT Foundation, an independent contractor for Dow AgroSciences).

Flutriafol showed good curative and eradicative activity against this disease following a single application of fungicide, similar to tebuconazole and myclobutanil, and was superior to the strobilurins alone or premixed (Stratego) and difenoconazole in control of Australasian soybean rust **(Table 18)**.

Table 18. Greenhouse infection of soybean by *Phakopsora pachyrhizi* (study done in Brazil). A single application of fungicide for rust control was applied when the inoculated soybeans showed around 5 - 10 % of infection level. This study focused on curative and eradicant features rather than protectant activity.

Treatment	**Rates**	**Disease Rating (1-5 scale)[1]**		
		7 DAT[2]	**18 DAT**	**30 DAT**
Untreated	n/a	2.63 a	3.13 a	4.13 a
propiconazole + trifloxystrobin (Stratego 250EC)	0.5	1.63 a	2.13 abcd	3.38 abc
pyraclostrobin (Opera)	0.5	1.63 a	1.38 d	2.38 cde
azoxystrobin (Priori)	0.2	1.88 b	2.13 abcd	3.25 abc
difenoconazole (Score)	0.3	1.75 b	1.88 bcd	3.25 abc
Impact (flutriafol)	1.0	1.88 b	1.63 cd	1.5 e
tebuconazole (Folicur)	0.4	1.75 b	1.63 cd	1.38 e
myclobutanil (Systhane EC)	0.25	1.88 b	2.0 bcd	2.38 cde
myclobutanil (Systhane EC)	0.3	1.63 b	2.13 abcd	2.75 bcd
myclobutanil (Systhane EC)	0.4	1.63 b	1.5 d	2.5 cde
myclobutanil (Systhane EC)	0.5	1.75 b	1.5 d	2.25 cde
CV (%)		**15**	**19.1**	**16.3**

[1] - Disease Scale: 1= No symptoms; 2= 1 - 10 % of infection level; 3= 11 - 25 % of infection level; 4= 26 - 50 % of infection level; 5= 50 - 100 % of infection level.
[2] – DAT = Days after treatment for evaluation.

Yield data for cyproconazole, prothioconazole and flutriafol are generally lacking. However, it is expected that a similar response will occur as is seen with other triazole funicides. Disease suppression with these active ingredients is similar to what is seen from other triazoles.

EXPECTED RESIDUE LEVELS IN FOOD (166.20(a)(6))

Metconazole – Based on field residue trials, the proposed tolerance for soybean seed will be 0.1 ppm **(see Appendix 2, this addendum).**

Flutriafol – Cheminova is conducting soybean residue trials in the U.S. in 2005 to develop data on residues of flutriafol under U.S. conditions in various soybean commodities. Tolerances are established for flutriafol in soybean of 0.1 ppm in Brazil and South Africa **(see Appendix 3, this addendum).**

Cyproconazole – Magnitude of residue trials on soybeans by Syngenta suggest a temporary tolerance of 0.1 ppm for soybean seed **(see Appendix 3, this addendum).**

Prothioconazole – Soybean residue trials in the U.S. were conducted in 2003 and are currently being analyzed with the intent of developing data on potential residues of prothioconazole in the various soybean commodities **(see Appendix 3, this addendum).**

Flusilazole – A temporary tolerance of 0.02 ppm can be proposed for flusilazole on soybeans **(see Appendix 1, this addendum).**

Famoxadone – A temporary tolerance of 0.05 ppm can be proposed for famoxadone on soybeans **(see Appendix 1, this addendum).**

DISCUSSION OF RISK INFORMATION (166.20(a)(7))

Minnesota has 13 listings of threatened and endangered species; nine animals and four plants.

- Animals - Of the nine animals, two are mammals (Canada Lynx, Gray Wolf), one is an insect (Karner Blue Butterfly), three are birds (Bald Eagle, Piping Plover, two different watersheds) two are mussels (Higgins Eye and Winged Mapleleaf) and one is a fish (Topeka shiner).

  Cyproconazole – Risk quotients of cyproconazole are below levels of concern for terrestrial animals, birds, insects, fish and aquatic invertebrates **(Appendix 4, this addendum).** Accordingly, risk to threatened and endangered animal species in Minnesota would be negligible from the use of cyproconazole proposed under this exemption request.

  Flusilazole – The ecotoxicological data **(Appendix 1, this addendum)** indicate a low acute and chronic toxicity of flusilazole for mammals, birds, aquatic organisms and honey bees when used at rates proposed in this exemption request. Accordingly, use of flusilazole under this exemption request would not be expected to be a threat to threatened and endangered animal species in Minnesota.

  Famoxadone – The EPA Pesticide Fact Sheet on famoxadone, July, 2003, **(Appendix 1, this addendum)** states that famoxadone has a low toxicity to mammals (LD_{50} > 5,000 mg/kg). The only endangered bird species with a famaxadone risk quotient of concern is native to Hawaii. Famoxadone may have negative effects on beneficial insects. In Minnesota, the endangered Karner blue butterfly is found only in Winona county. The Karner blue butterfly habitat is pine and oak savanna/barrens supporting wild lupine and nectar plants and is not found in soybean production areas. Famoxadone may be toxic to fish and aquatic invertebrates. In Minnesota the endangered Higgins Eye and Winged Mapleleaf mussels are found in the St. Croix River between Minnesota and Wisconsin. The counties adjacent to the St. Croix River in Minnesota account for less than one percent of the total soybean acres and are not in the primary soybean production areas of Minnesota. It is not likely that famoxadone would reach the mussel habitat and would not be expected to be continuously or recurrently present in water as a result of use under this exemption. The endangered Topeka shiner fish live in small to mid-sized prairie streams and is found only in sub-watersheds of the Missouri River basin. In Minnesota, this includes the counties of Lincoln, Murray, Nobles, Pipestone, and Rock. To mitigate risk to Topeka shiners from use of famoxadone under this sec. 18, the Minnesota sec. 18 famoxadone use directions would include a statement "To prevent risk to the endangered species Topeka shiner, famoxadone should not be applied in Lincoln, Murray, Nobles, Pipestone, or Rock counties if heavy rainfall is imminent." Based on the above discussion, the use of famoxadone under this exemption would not be a risk to threatened and endangered mammals, birds, insects, fish or aquatic organisms in Minnesota.

  Flutriafol – Flutriafol has a low toxicity to mammals, birds, and insects **(see Appendix 5, this addendum).** Flutriafol may be toxic to fish and aquatic invertebrates. In Minnesota the endangered Higgins Eye and Winged Mapleleaf mussels are found in the St. Croix River between Minnesota and Wisconsin. The counties adjacent to the St. Croix River in Minnesota account for less than one percent of the total soybean acres and are not in the primary soybean production areas of Minnesota. It is not likely that flutriafol would reach the mussel habitat and would not be expected to be continuously or recurrently present in water as a result of use under this exemption. The endangered Topeka shiner fish live in small to mid-sized prairie streams and is found only in sub-watersheds of the Missouri River basin. In Minnesota, this includes the counties of Lincoln, Murray, Nobles, Pipestone, and Rock. To mitigate risk to Topeka shiners from use of flutriafol under this sec. 18, the Minnesota sec. 18 flutriafol use directions would include a statement "To prevent risk to the endangered species Topeka shiner, flutriafol should not be applied in Lincoln, Murray, Nobles, Pipestone, or Rock counties if heavy rainfall is imminent." Based on the above discussion, the use of flutriafol under this exemption would not be a risk to threatened and endangered mammals, birds, insects, fish or aquatic organisms in Minnesota.

Prothioconazole – See **Appendix 6**, this addendum for a detailed discussion. Prothioconazole acute and chronic risk quotients for wild mammals were less than the regulatory level of concern indicating that prothioconazole would pose minimal risk to wild mammals. Prothioconazole is practically non-toxic to birds. Acute oral and contact toxicity tests demonstrated that prothioconazole had no effect on adult honey bees. Prothioconazole poses minimal acute and chronic risk to fish and aquatic invertebrates. Use of prothioconazole under this exemption would not be a risk to threatened and endangered animals in Minnesota.

Metconazole – See **Appendix 7**, this addendum for detailed discussion. Studies concluded that the short and long term metconazole risk for birds, wild mammals and insects is acceptable. Metconazole may be toxic to fish and aquatic invertebrates. In Minnesota the endangered Higgins Eye and Winged Mapleleaf mussels are found in the St. Croix River between Minnesota and Wisconsin. The counties adjacent to the St. Croix River in Minnesota account for less than one percent of the total soybean acres and are not in the primary soybean production areas of Minnesota. It is not likely that metconazole would reach the mussel habitat and would not be expected to be continuously or recurrently present in water as a result of use under this exemption. The endangered Topeka shiner fish live in small to mid-sized prairie streams and is found only in sub-watersheds of the Missouri River basin. In Minnesota, this includes the counties of Lincoln, Murray, Nobles, Pipestone, and Rock. To mitigate risk to Topeka shiners from use of metconazole under this sec. 18, the Minnesota sec. 18 metconazole use directions would include a statement "To prevent risk to the endangered species Topeka shiner, metconazole should not be applied in Lincoln, Murray, Nobles, Pipestone, or Rock counties if heavy rainfall is imminent." Use of metconazole under this exemption would not be a risk to threatened and endangered animal species in Minnesota.

- Plants - The four threatened and endangered plant species in Minnesota are the Minnesota Dwarf Trout Lily, the Prairie Bush-Clover, the Western Prairie Fringed Orchid, and Leedy's Roseroot. The Minnesota Dwarf Trout Lily is found on fewer than 600 acres of forest habitat and does not occur in areas of soybean cultivation. The Prairie Bush-Clover is found in prairie habitat. Most of the Prairie Bush-Clover in Minnesota is protected in dedicated state nature preserves, scientific and natural areas and preserves or protected by private landowners through conservation-minded agricultural practices. The Western Prairie Fringed Orchid is found in wet prairies and meadows. Most of the Western Prairie Fringed Orchid in Minnesota is protected in nature preserves and natural areas and by private landowners. Leedy's Roseroot is found on cool, wet groundwater-fed limestone cliffs and is not found in areas of soybean cultivation. Based on the above discussion, use of cyproconazole, flusilazole, famoxadone, prothioconazole, metconazole, and flutriafol under this exemption request would not be a risk to threatened and endangered plant species in Minnesota.

Cyproconazole, metconazole, flusilazole, prothioconazole, and flutriafol are triazole fungicides. EPA is evaluating the toxicological significance of triazole metabolites 1,2,4-triazole, triazolylalanine (TA) and triazolylacetic acid (TAA). Of the three metabolites, only 1,2,4-triazole can be considered toxicologically significant and EPA has identified developmental toxicity as the endpoint of concern. An industry Triazole Task Force has submitted worst-case studies **(Appendix J, original submission)** to EPA demonstrating a reasonable certainty of no harm for 1,2,4-triazole stemming from triazole-derivative fungicides for food only, as well as for food and water.

COORDINATION WITH OTHER AFFECTED FEDERAL, STATE, AND LOCAL AGENCIES (166.20(a)(8))

The South Dakota Department of Agriculture has provided a copy of this request to the State office of the United States Fish & Wildlife Service; the South Dakota Department of Game, Fish & Parks, Division of Wildlife; and the United States Environmental Protection Agency Region VIII Pesticide Program. Any comments provided to the Department of Agriculture will be forwarded to the EPA as they are received. Enclosed is the federal list of endangered and threatened species known to occur in South Dakota and Minnesota **(Appendix K, original submission)**.

NOTIFICATON OF REGISTRANT(166.20(a)(9))

The manufacturers of cyproconazole (Alto 3.6F) and cyproconazole + azoxystrobin (Quadris Xtra) – Syngenta; metconazole (Caramba) and metconazole + pyraclostrobin (Headline-Caramba CoPack or Operetta) – BASF Corporation; flusilazole (Punch) and flusilazole + famoxadone (Charisma) - DuPont Crop Protection, Inc.; prothioconazole (JAU6476) – Bayer Crop Science; and, flutriafol (Impact) – Cheminova, are aware of and supportive of this request. Letters of support and draft labels for soybeans have been received **(Appendix 3, this addendum)**.

ENFORCEMENT PROGRAM (166.20(a)(10))

The South Dakota Department of Agriculture first entered into an enforcement agreement with the Environmental Protection Agency in November 1978, and approved a formal Cooperative Enforcement Agreement in 1985. The South Dakota Department of Agriculture has been granted authority, pursuant to South Dakota Codified Law Chapters 38-20A and 38-21, to administer and carry out legislative intent related to the regulation and use of pesticides. Pursuant to South Dakota Codified Law Chapter 38-21-52, the Department has the authority to enter into cooperative agreements with other agencies. These statutes remain consistent with the intent of FIFRA. The South Dakota Department of Agriculture continues to carry out an efficient and effective pesticide program. The Department plans to conduct routine pesticide use investigations pertaining to the use of pesticides under section 18 emergency exemption registrations. The Department will also respond to all complaints of misuse.

The Minnesota Department of Agriculture will take appropriate steps to ensure that the conditions of this exemption are met.

REPEAT USES(166.20(a)(11))

This request is the first request for the use of each of the requested products; Alto, Quadris Xtra, Caramba, Headline-Caramba, Operetta, Punch, Charisma, JAU 6476, and Impact on soybean by all states.

PROGRESS TOWARD REGISTRATION (166.25(b)(2)(ii))

Cyproconazole – Syngenta is pursuing registration of cyproconazole on soybeans and has previously submitted to EPA studies on the magnitude of the residues in soybean seed, dietary risk, environmental fate, ecological risk, a drinking water assessment, and an occupational assessment.

Flusilazole – DuPont is actively pursuing registration of flusilazole on soybeans. **See Appendix 1**, this addendum for studies on product chemistry, toxicology and ecotoxicology, environmental fate and residues.

Famoxadone – Dupont is actively pursuing registration of famoxadone on soybeans. See **Appendix 1**, this addendum for studies on product chemistry, toxicology and ecotoxicology, environmental fate and residues.

Prothioconazole – Bayer submitted a registration package for prothioconazole on soybeans on March 31, 2004.

Metconazole – Petition number 9E5052 for a banana import tolerance was filed with EPA in December 1998. Metconazole is currently registered in other countries for use in cereals, oilseed rape, and pulses, and BASF is generating data to support a soybean tolerance **(Appendix 2, this addendum).**

Flutriafol – Cheminova will submit its first application for registration of flutriafol to EPA this summer. Field residue and processing studies on soybeans in the U.S. are underway.

NAME OF PEST (166.20(c)(1))

Scientific Name: *Phakopsora pachyrhizi* H. Sydow and Sydow
Common Name: Australasian soybean rust

ORIGIN OF INTRODUCED PEST (166.20(c)(2))

Australasian soybean rust, when introduced to the United States, has the potential of being a widespread, damaging disease, capable of causing losses in all soybean production areas on the United States soybean acreage. With more than 73 million acres of soybeans in the United States, industry sources have communicated that a supply of one or two fungicides, including the currently registered products, will likely be insufficient for the vast acreage of soybeans potentially affected. The joint supplies of several fungicides representing several different products will more than likely be required to combat an outbreak. We do not envision registrants, dealers, or producers stockpiling fungicide to combat a potential outbreak due to the tremendous potential inventory cost for the unused product.

Local conditions demand the ability to choose between several fungicides – one or two products may be found ineffective in the early days of an epidemic, despite Africa and South America efficacy trials. Efficacy is really a local issue. Unfortunately, the nature of this threat precludes local testing which normally serves us so well.

Resistance management demands an alternation of chemistries applied, especially for a pathogen that reproduces so rapidly and is spread aerially over great distances. FRAC guidelines direct producers and applicators to alternate chemistries or modes of action, not only locally but also regionally, to effectively blockade any resistance that does develop. Also, combination products may prove an effective tool in limiting resistance development, especially the combination of an older multi-site inhibitor, such as chlorothalonil or mancozeb, with one of the newer, systemic compounds, such as the triazoles or strobilurins.

Australasian soybean rust is known to occur and cause serious crop losses in Asia (China, Korea, India, Japan, Nepal, Russia, Taiwan, Thailand, the Philippines), Australia, Africa (Mozambique, Nigeria, Rwanda, South Africa, Uganda, Zambia, and Zimbabwe), and since 2000, in South America (Argentina, Brazil, and Paraguay). As of April 2003, Australasian soybean rust has not yet been detected in the continental United States. It has been present in Hawaii since 1994 (anonymous, 2002). However, the pathogen is spread by wind-borne spores, suggesting that it may reach major soybean production areas in the United States. Presumably, the pathogen entered South America as wind-borne urediniospores blown across the Atlantic Ocean, very similar to the path presumptively taken by the sorghum ergot pathogen **(Appendix C- Figure 1, original submission)**. Once introduced, the pathogen is airborne and may follow a pathway similar to the wheat stem rust and leaf rust pathway, northward through the central US **(Appendix C- Figure 2, original**

submission) or the dispersal pattern like the Southern corn leaf blight pathogen during the US epidemic of 1970 **(Appendix C- Figure1, original submission)**.

Soybean rust is caused by two morphologically similar fungal species, *Phakopsora pachyrhizi* and *Phakopsora meibomiae*. *P. meibomiae* was reported in Puerto Rico in 1976, but this species has proven to be a weak pathogen. The much more aggressive *Phakopsora pachyrhizi* was reported in Hawaii in 1995. Introductions of *P. pachyrhizi* in other parts of the world more recently have shown rapid spread and severe crop damage in Zimbabwe, South Africa, Paraguay, and Brazil. Yield losses have been reported from 10-80%.

One of the primary issues complicating the detection and control of this insidious pest are the large number of legume hosts that can serve as alternative hosts for soybean rust. In addition to soybean, there are 30 species of legumes across 17 genera that have been reported to be hosts for soybean rust in nature. Additionally, 60 species in 26 genera have been successfully inoculated in the laboratory. There is a great threat for inoculum production on a widespread weed host in the United States, *Pueraria montana* var. *lobata* commonly known as kudzu. Many other leguminous crops and weeds have also shown varying degrees of susceptibility to both species of Soybean rust. Some common hosts include yellow sweet clover *(Melilotus officinalis)*, vetch (*Vicia dasycarpa*), medic (*Medicago arborea*), lupine *(Lupinus hirsutus)*, green and kidney bean (*Phaseolus vulgaris*), lima and butter bean *(Phaseolus lunatus)*, and cowpea or black-eyed pea (*Vigna unguiculata*) (anonymous, 2002). See **Appendix F, original submission** for ASA Soybean Rust Alert, Plant Health Initiative, APHIS Data Sheet, USB Soybean Rust Alert Publication.

Nearly 74,000,000 acres of soybeans are grown in the United States. Nationally, soybeans account for 73.8 million planted acres, 2.75 billion bushels produced, and over $13 billion value of production. Even a modest 4% minimal loss of production would reduce domestic soybean production to its lowest point in the preceding five years. Depending on the crop stage when disease onset occurs, losses could vary dramatically from field to field. South Dakota grows approximately 4 million acres of soybeans, the most widely planted crop in the state in 2001 and 2002. Counties in the Southeast and East Central crop reporting districts are at the greatest risk of soybean rust due to more common high relative humidity and common use of windbreaks that increase relative humidity and prolong dew periods. Minnesota grows more than 7 million acres of soybeans, also the most widely planted crop in the state in 2002. Counties in the South Central, Southwest, West Central, and Central crop reporting districts are at the greatest risk of soybean rust due to more common high relative humidity and common use of windbreaks that increase relative humidity and prolong dew periods and the influence of the Minnesota River Valley over a large portion of the central and west central parts of the state. Additionally, extensive expansion of soybeans in the Northwestern crop reporting district also leaves that area at risk.

IMPACT OF THE PEST (166.20(c)(3))

Product cost must be considered in selecting efficacious products. Several commodity representatives have told us that three applications of a fungicide could cost about $45/acre. These are new costs to production. Fungicides are not commonly applied on soybeans in the US. Soybean producer representatives have indicated that such costs would exceed profits for many producers under current conditions. Depending on the area of the country and environment in the year, profitability on the farm is tenuous. A selection of products should be made available to allow for reasonable soybean rust management under various economic management situations. Also, a variety of fungicides are needed to provide adequate supplies of efficacious fungicides at reasonable prices thereby avoiding market-induced high prices.

Soybean rust is a potentially devastating disease. A variety of published reports have indicated that soybean rust is capable of causing yield reductions area-wide on soybeans from 10 to 50% and in selected fields over 90%. We do not know of any published reports on yield reductions on other leguminous crops that are known to be susceptible to the soybean rust pathogen, but similar impacts are possible. Two USDA Economic

Research Service reports that were published in 1984 estimated that total U.S. losses from soybean rust five years following its introduction could range from $592 million/year to as high as $19.9 billion/year in 1986 dollars (Kuchler et al. 1984; Kuchler and Duffy. 1984) **(Appendix L, original submission).** Assumed yield losses in these scenarios ranged from 4% to 25%, with and without grower response to soybean rust. Total losses would not only be due to soybean yield losses but also to the disruptive effect on the soybean feed and food industries. However, producers would realize higher prices for harvested soybeans and corn following a soybean rust epidemic, reducing the negative effect of soybean rust. The net effect to the U.S. economy was estimated to range from $235 million/year to $4.5 billion/year.

If losses comparable to the 60% figures experienced in Brazil were to occur the already fragile farm economy would be tragically impacted.

Projected losses: If soybean rust is introduced to the US late in any given season, losses may be small. However, introduction of the diseases early could be very serious. It is currently not known how the disease would impact markets. The Economic Research Service of USDA is in the process of completing a rewrite of the potential effects of soybean rust entering the US but is not available at this time. However, a brief analysis was compiled and is included in draft form **(Appendix L, original submission).**

Economic Data From The Past Five Years

The past several years in South Dakota and Minnesota have been full of environmental change. Moisture was plentiful in the early to mid 1990s and in recent years conditions have been drier than normal. Nonetheless, conditions are on average very favorable for the development of soybean rust over most of Minnesota, eastern South Dakota and a large portion of the United States.

Soybean Production.

Table 18: South Dakota statewide soybean production.

Year	Avg. Yield Per Acre (Bushels)*	Average Price Per Bushel*	Gross Revenue Per Acre	Average Costs Per Acre**	Net Revenue Per Acre
1998	38.9	$ 4.60	$ 178.94	$ 163.00	$ 15.94
1999	36.6	$ 4.33	$ 158.48	$ 166.00	($ 7.52)
2000	38.1	$ 4.27	$ 162.69	$ 168.00	($ 5.31)
2001	35.0	$ 4.13	$ 144.55	$ 164.00	($ 19.45)
2002	31.0	$ 5.15	$ 159.65	$ 166.00	($ 6.35)
2003	27.5	$ 6.96	$ 191.40	$ 163.00	$ 28.40
6 yr. Ave.	34.5	$ 4.91	$ 165.95	$ 165.00	$ 0.95

* USDA, http://www.nass.usda.gov:81/ipedb/
**Source: SDSU Economics Department estimate.

Table 19: Minnesota statewide soybean production.

Year	Avg. Yield Per Acre (Bushels)*	Average Price Per Bushel*	Gross Revenue Per Acre	Average Costs Per Acre**	Net Revenue Per Acre
1998	42.0	$ 4.65	$ 195.30	$ 180.33	$ 14.97
1999	42.0	$ 4.42	$ 185.64	$ 170.56	$ 15.08
2000	41.0	$ 4.38	$ 179.58	$ 168.24	$ 11.34
2001	37.0	$ 4.32	$ 159.84	$ 171.35	$ 11.51
2002	43.5	$ 5.25	$ 228.37	$ 165.00	$ 63.37
2003	32.0	$ 7.26	$ 232.32	$ 203.54	$ 28.78
6 yr. Ave.	39.6	$ 5.04	$ 196.84	$ 176.51	$ 20.34

*USDA-National Agricultural Statistics Service, http://www.nass.usda.gov:81/ipedb/
**Source: UMN Department of Applied Economics (http://134.84.17.199/FINBIN/output/20089.htm)

Table 20: United States soybean production.

Year	Avg. Yield Per Acre (Bushels)*	Average Price Per Bushel*	Gross Revenue Per Acre	Average Costs Per Acre**	Net Revenue Per Acre
1998	38.9	$ 4.93	$ 191.78	$ 180.33	$ 11.45
1999	36.6	$ 4.63	$ 169.46	$ 170.56	($ 1.10)
2000	38.1	$ 4.54	$ 172.97	$ 168.24	$ 41.73
2001	39.6	$ 4.38	$ 173.45	$ 171.35	$ 2.10
2002	37.8	$ 5.40	$ 204.12	$ 165.00	$ 39.12
2003	33.9	$ 7.34	$ 248.83	$ 203.54	$ 45.29
6 yr. Ave.	37.4	$ 5.21	$ 194.85	$ 176.51	$ 16.73

* USDA, http://www.nass.usda.gov:81/ipedb/
** MN values used as a reference point - Source: UMN Department of Applied Economics (accessed May 2003 http://134.84.17.199/FINBIN/output/20089.htm and http://www.finbin.umn.edu/CropEnterpriseAnalysis/Default.aspx)

Cost of production data for 16 soybean producing states is available through the National Ag Risk Education Library Budget Section (http://www.agrisk.umn.edu/Default.aspx?Lib=Budget&P=CustomSearch). The cost of soybean production yields near the National average of 38 bu/A, ranged from $99.74 - $346.09 (average $193.18). As such the analysis in **Table 20** reflects a fair estimate of economics of soybean production based on Minnesota cost of production numbers paired with national figures for yield and price. Profitability of the crop has been variable over the past five years and in some locations, such as South Dakota, producers may have been operating at a loss **(Table 18)**, while in Minnesota the crop was more profitable due to greater rainfall **(Table 19)**. Some other states and production systems reported similar losses.

Estimated Revenues For The Site To Be Treated

Costs of fungicides:

- **Labeled products:**
  - chlorothalonil............................ $ 42.00/gal.................... 1.375-2.25 pts/A..= ....$ 7.20-11.81/A
  - azoxystrobin............................ $ 266.19/gal.................. 6.2-15.4 fl oz/A... = ...$ 12.89-32.02/A
  - pyraclostrobin .... $ 231.00/gal .... 6 - 12 fl oz/A..... = ...$ 10.83 – 21.66/A

- **Proposed Section 18 products:**
  - propiconazole............................ $ 325.19/gal.................. 4-8 fl oz/A .... = ...$ 10.16 - 20.32/A
  - tebuconazole .... $ 335.25/gal.................. 3-4 fl oz/A........ = ...$ 7.85-10.47/A
  - myclobutanil............................. $ 184.00/gal.................. 4-8 fl oz/A........ = ...$ 5.75-11.50/A
  - propiconazole + trifloxystrobin .... $ 150.50/gal.................. 5.5-10 fl oz/A..... = ...$ 6.47 - 11.76/A
  - tetraconazole............................ $ 159.00/gal.................. 13 fl oz/A......... = ...$ 16.15/A
  - propiconazole + azoxystrobin .... $ 112.00/gal.................. 14-20.5 fl oz/A... = ...$ 12.25 - 17.94/A
  - tebuconazole + pyraclostrobin .... $ 246.00/gal.................. 7.8 fl oz/A......... = ...$ 15.00/A (company estimate)
  - **cyproconazole........................... $ 248.00/gal.................. 2.75-4 fl oz/A .... = ...$ 5.50-8.00/A (company estimate)**
  - **cyproconazole + azoxystrobin... $ 320.00/gal.................. 4 fl oz/A........ = ...$ 10.00/A (company estimate)**
  - **metconazole............................ $ 160.00/gal.................. 8.2-9.6 fl oz/A.....= ....$ 10.25-12.00/A (co. estimate)**
  - **metconazole + pyraclostrobin (co)$ 199.17/gal..................6.08+3.56 fl oz/A = ...$ 15.00/A (co. estimate)**
  - **metconazole + pyraclotrobin (pre)$ 215.73/gal.................. 8.9 fl oz/A......... = ...$ 15.00/A (company estimate)**
  - **flusilazole .... $ 248.00/gal.................. 4 fl oz/A........... = ...$ 8.00/A (company estimate)**
  - **flusilazole + famoxadone .... $ 170.67/gal.................. 9 fl oz/A........... = ...$ 12.00/A (company estimate)**
  - **prothioconazole .... $ 365.71/gal.................. 2.85-3.5 fl oz/A.. =.........$ 8.14-10.00/A (co. estimate)**
  - **flutriafol........... .... $ 149.15-158.30/gal........ 7 fl oz/A.. =.........$ 8.15-$8.65/A (co. estimate)**

- **Application and preharvest intervals (for amendment products):**
  - cyproconazole... when conditions are favorable for disease............... 30 day PHI
  - cyproconazole + azoxystrobin.................... when conditions are favorable for disease............... 30 day PHI
  - metconazole... at R1 or prior to disease development.................... 30 day PHI
  - metconazole + pyraclotrobin copack........... at R1 or prior to disease development.................... 30 day PHI
  - metconazole + pyraclotrobin premix .... at R1 or prior to disease development.................... 30 day PHI
  - flusilazole .... timing not specifically stated .... 30 day PHI
  - flusilazole + famoxadone .... timing not specifically stated .... 30 day PHI
  - prothioconazole .... prior to first symptoms of disease development......... 30 day PHI
  - flutriafol... at first appearance of rust symptoms........................ 21 day PHI

Soybeans – Estimated Return For Fungicide Application:

Market Price of Soybean	$ 4.91/bu (So. Dakota)	$ 5.04/bu (Minnesota)	*(6-year average)*
Yield Potential	34.5 bu/A (So. Dakota)	39.6 bu/A (Minnesota)	*(6-year average)*

Table 21. Fungicide + Application Costs per Application:

Fungicide	Number of Applications*	Product Cost	Application Cost**	Cost of Treatment
chlorothalonil	1	$ 7.20 – 11.81	+ $ 3.90 ground application	= $ 10.70 – 15.31
	1		+ $ 5.47 aerial application	= $ 12.67 – 17.20
azoxystrobin	1	$12.89 – 32.02	+ $ 3.90 ground application	= $ 16.79 – 35.92
	1		+ $ 5.47 aerial application	= $ 18.36 – 37.49
tebuconazole	1	$ 10.47	+ $ 3.90 ground application	= $ 13.97
	1		+ $ 5.47 aerial application	= $ 15.94
propiconazole	1	$ 10.16	+ $ 3.90 ground application	= $ 13.66
	1		+ $ 5.47 aerial application	= $ 15.63
myclobutanil	1	$ 10.50	+ $ 3.90 ground application	= $ 14.40
	1		+ $ 5.47 aerial application	= $ 15.97
propiconazole + trifloxystrobin	1	$ 11.76	+ $ 3.90 ground application	= $ 15.66
	1		+ $ 5.47 aerial application	= $ 17.47
tetraconazole	1	$ 12.31 - 16.00	+ $ 3.90 ground application	= $ 16.21 – 19.90
	1		+ $ 5.47 aerial application	= $ 17.78 – 21.47
pyraclostrobin + boscalid	1	$ 12.00 – 23.00	+ $ 3.90 ground application	= $ 15.90 – 26.90
	1	Estimate – price [illegible] manufacturer	+ $ 5.47 aerial application	= $ 17.90 – 28.47
pyraclostrobin	1	$ 10.83 – 21.65	+ $ 3.90 ground application	= $ 14.73 – 25.55
	1		+ $ 5.47 aerial application	= $ 16.30 – 27.12
propiconazole + azoxystrobin	1	$ 12.25 – 17.94	+ $ 3.90 ground application	= $ 16.15 – 21.84
	1		+ $ 5.47 aerial application	= $ 17.72 – 23.41
tebuconazole + pyraclostrobin	1	$ 15.00	+ $ 3.90 ground application	= $ 18.90
	1		+ $ 5.47 aerial application	= $ 20.47
cyproconazole	1	$5.50-8.00	+ $ 3.90 ground application	= $9.40-11.90
	1		+ $ 5.47 aerial application	= $10.97-13.47
cyproconazole + azoxystrobin	1	$10.00	+ $ 3.90 ground application	= $13.90
	1		+ $ 5.47 aerial application	= $15.47
metconazole	1	$10.25-12.00	+ $ 3.90 ground application	= $14.15-15.90
	1		+ $ 5.47 aerial application	= $15.72-17.47
metconazole + pyraclostrobin	1	$15.00	+ $ 3.90 ground application	= $18.90
	1		+ $ 5.47 aerial application	= $20.47
flusilazole	1	$8.00	+ $ 3.90 ground application	= $11.90
	1		+ $ 5.47 aerial application	= $13.47
flusilazole + famoxadone	1	$12.00	+ $ 3.90 ground application	= 15.90
	1		+ $ 5.47 aerial application	= 17.47
prothioconazole	1	$8.14-10.00	+ $ 3.90 ground application	= $12.04-13.90
	1		+ $ 5.47 aerial application	= $13.61-15.47
flutriafol	1	$8.65 (high end estimate)	+ $ 3.90 ground application	= $12.55
	1		+ $ 5.47 aerial application	= $13.12

* Cost of treatment would need to be increased proportionately for multiple fungicide applications.
** 2002 South Dakota Custom Application Rates
(accessed May 2003 http://www.nass.usda.gov/sd/releases/cstmrt00.pdf) – Application cost may be saved in some instances if the fungicide can be tank mixed with a planned herbicide application. No data is available as yet to support the compatibility of any of the fungicide products and herbicides in a soybean system.

It is assumed from the available data that the triazole fungicides and FRAC Group 3 + FRAC Group 11 fungicide combinations will perform similarly. The proposed Section 18 products appear to offer the potential of 60-80 % yield advantage. We will use 50% as a conservative estimate for the requested products and azoxystrobin. No estimate can be made for chlorothalonil. These assumptions and assumptions from the pricing above were used to construct the following table for soybean:

Table 22. Projected return from fungicides

	A	B	C (= A X B)	D	E = C - D
Option	**Expected Yield* /Increase (bu/A)**	**Soybean Price†**	**Gross Revenue/A from fungicide (best case)**	**Fungicide Cost + Applic. Cost/A‡**	**Net Revenue/A**
chlorothalonil (labeled)	38 / 2	$ 4.91	$ 9.82	$ 10.70 – 15.31 $ 12.67 – 17.20	($ 0.86 – 5.49) – ($ 2.85 – 7.38)
azoxystrobin (labeled)	38 / 12.6	$ 4.91	$ 61.86	$ 16.79 – 35.92 $ 18.36 – 37.49	$ 45.07 – 25.94 $ 43.50 - 24.37
tebuconazole	38 / 12.6	$ 4.91	$ 61.86	$ 13.97 $ 15.94	$ 47.89 – $ 45.92
propiconazole	38 / 12.6	$ 4.91	$ 61.86	$ 13.66 $ 15.63	$ 48.20 – $ 46.23
myclobutanil	38 / 12.6	$ 4.91	$ 61.86	$ 14.40 $ 15.97	$ 47.46 – $ 45.89
propiconazole + trifloxystrobin	38 / 12.6	$ 4.91	$ 61.86	$ 15.66 $ 17.47	$ 46.20 – $ 44.39
tetraconazole	38 / 1.2	$ 4.91	$ 5.89	$ 16.21 – 19.90 $ 17.78 – 21.47	($ 10.32 – 14.01) – ($ 11.89 – 15.58)
Pyraclostrobin + boscalid	38 / 4.6	$ 4.91	$ 22.59	$ 15.90 – 26.90 $ 17.90 – 28.47	$ 6.69 – (4.31) – $ 4.69 - (5.82)
pyraclostrobin	38 / 2.7	$ 4.91	$ 13.26	$ 14.73 – 25.55 $ 16.30 – 27.12	($ 1.47 – 12.29) – ($ 3.04 – 13.86)
propiconazole + azoxystrobin	38 / 11.5	$ 4.91	$ 56.46	$ 16.15–21.84 $ 17.72–23.41	$ 40.31 – 34.62 $ 38.74 – 33.05
tebuconazole + pyraclostrobin	38 / 7.8	$ 4.91	$ 38.30	$ 18.90-20.47	$ 19.40 – 17.83
cyproconazole	38 / ___°	$ 4.91	$ ___°	$9.40-11.90 $10.97-13.47	N/A
cyproconazole + azoxystrobin	38 / 2.7^	$ 4.91	$ 13.26	$13.90 $15.47	($ 0.64) ($ 2.21)
metconazole	38 / 16.2	$ 4.91	$ 79.54	$14.15-15.90 $15.72-17.47	$ 65.39 – 64.64 $ 63.84 – 62.07
metconazole + pyraclostrobin	38 / 57.0	$ 4.91	$ 279.88	$18.90 $20.47	$ 260.98 $ 259.41
flusilazole	38 / ___°	$ 4.91	$ ___°	$11.90 $13.47	N/A
flusilazole + famoxadone	38 / ___°	$ 4.91	$ ___°	15.90 17.47	N/A
prothioconazole	38 / ___°	$ 4.91	$ ___°	$12.04-13.90 $13.61-15.47	N/A
flutriafol	38 / ___°	$ 4.91	$ ___°	$12.55 $13.12	N/A
Untreated control	25.4 / (12.6)	$ 4.91	N/A	N/A	($ 61.87)

* Assuming the protection of a 38 bushel per acre soybean yield - difference between 38 and 25.4 is 12.6 bu/A, roughly the 37.4 bushel per acre soybean yield (mean US soybean yield for past six years) – 37.4 bu/A less optimal yield response equals 25.6 bu/A (estimated untreated yield)
† Based on mean US market price from past six years
‡ Based on a single application at the low and high rate applied by ground and/or air
‡ Based on only Paraguay locations – not included in Zimbabwe trials
° Because of insufficient or unavailable yield data, no response is known for this compound
^ Skewed by one Paraguay study location with a negative yield response
N/A - no data available for this calculation

Therefore, we can see a comparable advantage to the triazole products relative to azoxystrobin (if applied at low rates), while allowing greater product availability to address a potential epidemic. In fact the economics of a decision to use a high rate of azoxystrobin, which is preferred for longer residual, more effective disease control and better fungicide resistance management, offer only about half the advantage of using a triazole or pre-blended product such as Stratego or Quilt. Obviously, the lower priced products have a greater likelihood of economic return when two applications are used, particularly if prices are depressed.

The above statement was included in the initial submission of this Section 18 request. A similar response should be expected with the products requested in this amendment. While insufficient yield data is available fo several of the triazoles, sufficient disease response data is presented to suggest a similar yield response to other triazoles. Similarly, it should be expected that the combination MOA products in this submission will produce a response at least comparable to Stratego and in some cases more like the stronger combination products Quilt and Headline SBR.

Comparison of estimated revenue in treating with the next most expensive triazole <u>vs.</u> best labeled product (estimates*) assuming 1 million acres treated:

Estimated cost of treatment (1 million soybean acres x $ 14.40/acre) using a solo triazole (such as myclobutanil)	= $ 14.4 million
Estimated cost of treatment (1 million soybean acres x $ 16.79/acre) using azoxystrobin	= $ 16.8 million
advantage with triazole:	**= $ 2.4 million**

The above economic analysis does not reflect the benefit of reducing risk of resistance to strobilurin chemistry.

* Variability in the relative paucity of available data causes need for estimation of potential efficacy of products. Depending on disease pressure and production environment, some applications have been very efficacious while at other locations and in different environments, other products have performed better.

APPENDICES

1. DuPont Punch (active ingredient: flusilazole) and DuPont Charisma (active ingredients: flusilazole and famoxadone): Summary of Data Compiled in Support of a Section 18 Emergency Exemption Request for Control of Asian Soybean Rust on Soybeans

2. BASF metconazole registration support documents

3. Letters of support and draft use directions

4. Ecological Risk Assessment for an Emergency Exemption, Sec. 18, for Alto 100SL, Active Ingredient Cyproconazole for the Control of Asian Rust on Soybean; Cyproconazole – Soybean Rust Executive Summary

5. Flutriafol Technical Bulletin

6. Prothioconazole Effects on Non-Target Species

7. Metconazole Ecotoxicology