ASIAN SOYBEAN RUST
Independent Research Results

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PREV-AM® from ORO AGRI®
INTRODUCTION

Soybeans, *Glycine max* (L.) Merrill. are grown from temperate to tropical regions of the world, with production being highest in the United States, Brazil and China. Due to an increased production throughout the world, diseases that affect this crop have also therefore increased in number and severity. Soybeans are affected by more than 100 pathogens, with approximately 35 of economic importance.

Asian soybean rust, caused by *Phakopsora pachyrhizi* H. & P. Sydow, is one of the major diseases limiting soybean yield and has the potential for severe yield losses, due to early senescence, fewer pods and smaller seeds, and is therefore considered as the most destructive foliar disease of soybeans. Yield losses of 50-60% are common if uncontrolled, as well as complete crop losses where early infection and favourable environmental conditions exist. Rust epidemics are most severe during extended periods of leaf wetness when the average daily temperature is less than 28°C and relative humidity varies between 75-80%. Moisture on plant surfaces is crucial for germination. Areas where prolonged periods of leaf wetness due to dew, mist and light rain occur provide optimum conditions for germination.

The first report of Asian soybean rust in the United States of America was made on 10 November 2004, after soybean leaf samples from Louisiana tested positive for *P. pachyrhizi*. The pathogen is suspected to have blown in from South America with Hurricane Ivan. Since the first report in early November, several more cases have been reported with SBR, now confirmed by the United States Department of Agriculture’s Animal and Plant Health Inspection Service as present in six states: Alabama, Arkansas, Florida, Georgia, Louisiana and Mississippi.

The USA has been fortunate in the timing of the arrival of the pathogen, as most of the crop is close to maturity or already harvested, with the economic impact alleviated. Meetings have been scheduled for the winter to plan a control strategy for the 2005 season.

Chemical control is not the only method for controlling this destructive fungal disease of soybeans. Other options such as breeding resistant cultivars, controlling alternate hosts, adjusting agronomic practices such as fertility and planting space and density and biological control, can all be integrated to give enhanced control of soybean rust. More recently, research investigating the efficacy of organic fungicides is being carried out.
MATERIAL AND METHODS

Trials were planted on a farm approximately 5 km from Cedara (29°32’S, 30°17’E) at an altitude of 1 070 m, KwaZulu-Natal, South Africa on 14 November 2004. A medium season cultivar, Prima 2000, was mechanically planted at a row spacing of 38 cm and a plant population of 450 000 plants/ha. Standard fertilizer, herbicide and insecticide practices were followed.

Insecticides and herbicides were applied after planting but before commencement of the trial. Flumetsulam/s-metolachlor (1.7 ℓ/ha), s-metolachlor (0.375 ℓ/ha) and lambda-cyhalothrin (0.125 ℓ/ha) were sprayed using a knapsack sprayer applying 240 ℓ/ha. Plots comprised six of 5.0 m rows spaced 38 cm apart. The trial was laid out in a randomised complete block design with four replicates. The central two rows of each plot were sprayed with the fungicides, while the outer two rows on each side were used as guard rows. The central 4.0 m portions of the two sprayed rows will be hand-harvested. Grain yields were adjusted to a moisture content of 12.5% and expressed as ton/ha.

Treatments
1. Untreated control
2. 0.4% PREV-AM® once every 7 days from flowering
3. 0.8% PREV-AM® sprayed same as above for the 2X treatment.
4. Chlorothalonil once initially after flowering, followed by azoxystrobin approximately 10 days later, followed by chlorothalonil approximately 21 days later.
5. The same as in 4 but with 0.4% PREV-AM® added for each spray treatment

The 2004-2005 growing season was characterised by mild temperatures and above average rainfall during the months of January to March (Table 1) and April. The weather conditions until flowering were mild with a dry start to the season.

Table 1. Rainfall and temperature at Cedara (5km from trial site) for the 2004-2005 growing season.

<table>
<thead>
<tr>
<th>Rainfall (mm)</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
<th>March</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean monthly rainfall</td>
<td>166.4</td>
<td>131.8</td>
<td>139.6</td>
<td>115.9</td>
<td>110.5</td>
</tr>
<tr>
<td>Mean temperature (°C)</td>
<td>19.47</td>
<td>20.01</td>
<td>19.41</td>
<td>20.25</td>
<td>17.76</td>
</tr>
</tbody>
</table>

Planting dates and fungicide treatment
The trial was planted on 14 November 2004. For treatments 2 and 3, PREV-AM® 0.4% (8ml/2ℓ) and PREV-AM® 0.8% (16ml/2ℓ) respectively, applications commenced at R1 (first flower) continuing at ±7 day intervals i.e. applications 71, 76, 83, 93, 97, 104, 111, 118, and 129 days after planting (DAP). Treatment 4 was sprayed with chlorothalonil at 2000ml/ha (26.7ml/2ℓ) commencing after flower, 93 DAP, followed by an application of azoxystrobin at 400ml/ha (5.3ml/2ℓ) 104 DAP with a final application of chlorothalonil at 2000ml/ha (26.7ml/2ℓ) 129 DAP. Treatment 5 was sprayed as treatment 4, except all applications were amended with 0.4% PREV-AM® (8ml/2ℓ).
Application timing

<table>
<thead>
<tr>
<th>Treatment</th>
<th>UTC</th>
<th>Spray Intervals</th>
</tr>
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<tr>
<td>1</td>
<td></td>
<td>PREV-AM (0.4%)</td>
</tr>
<tr>
<td>2</td>
<td>24-Jan</td>
<td>29-Jan</td>
</tr>
<tr>
<td>3</td>
<td>24-Jan</td>
<td>29-Jan</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Chlorothalonil (2 l/ha)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Azoxystrobin (0.4 l/ha)</td>
</tr>
<tr>
<td>4</td>
<td>15-Feb</td>
<td>26-Feb</td>
</tr>
<tr>
<td>5</td>
<td>15-Feb</td>
<td>26-Feb</td>
</tr>
</tbody>
</table>

Quantities of fungicide were mixed in two litres of water to make-up spray solutions. Spray solutions were applied with a battery-operated-pressured back-pack sprayer, Lurmark hollow cone ceramic (ATR80), with a horizontal spray-boom with two nozzles spaced 50 cm apart. Full cover sprays of 150ℓ/ha at 2 bar pressure was applied to each data row. Calculations for the amount of chemical to be used were based on a walking speed of 1m/s.

Inoculation
The trial was inoculated twice, 90 and 97 DAP, by stapling green infected leaves to the border rows of the plots.

Disease and assessment
Disease severity assessments were made at about weekly intervals for seven weeks on the data plots (See Fig. 1 for dates), from full bloom, and continued until the crop was physiologically mature. This data was used for calculating the area under disease progress curve (AUDPC), which is the summary of the disease epidemic. Phytotoxicity assessments could not be made due to herbicide damage on the foliage.

Statistical analysis
Statistical analysis of trial data will be conducted by analysis of variance (ANOVA) using Genstat Version 6.1 and mean separations to be based on the least significant differences (LSD) at the 5% level of probability.
RESULTS

Flowering (50% flower) occurred 75 DAP. Disease was first observed in the trial 93 DAP. The trial was harvested 10/05/2005.

Fungicide evaluation

Fungicide treatments reduced percentage disease severity and final disease severity. The preventative use of PREV-AM® at both 0.4% and 0.8% concentrations provided comparable control of Asian soybean rust when equated with combinations of alternative applications of chlorothalonil and azoxystrobin. The use of PREV-AM® in the chlorothalonil/azoxystrobin programme significantly increased yield compared to no PREV-AM® in the programme. Chart representation of the means of the disease assessment data is in Fig. 1. Figure 2 shows the effect of AUDPC on yield and is a summary of disease through the season (the higher the value the more disease present).

Table 1. Summary of disease progression, AUDPC and yield data

<table>
<thead>
<tr>
<th>Rep</th>
<th>Treatment</th>
<th>15-Feb</th>
<th>26-Feb</th>
<th>02-Mar</th>
<th>09-Mar</th>
<th>15-Mar</th>
<th>28-Mar</th>
<th>Yield</th>
<th>AUDPC</th>
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<tr>
<td></td>
<td></td>
<td>Rust%</td>
<td>Rust%</td>
<td>Rust%</td>
<td>Rust%</td>
<td>Rust%</td>
<td>Rust%</td>
<td>mt/ha</td>
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<tr>
<td>1</td>
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<td>5</td>
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<td></td>
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LSD 1.364   2.17  3.268  5.231  25.49   216.5  0.971
Cv% 162.5   96   65.5   39.1   33.3    32.1   19.7
F Prob UTC vs Rest 0.027  0.007 <0.001 <0.001 <0.001 <0.001  0.129

*means followed by a letter indicate significant difference at 5%
**Figure 1.** Percentage of Asian soybean rust present on leaves of the data rows evaluated for each treatment.

**Figure 2.** Summary of AUDPC and yield per treatment.
**DISCUSSION**

The use of PREV-AM® at both the 0.4% and 0.8% concentrations provided control of Asian soybean rust comparable to that of alternative sprays of chlorothalonil and azoxystrobin. Since the application of PREV-AM® commenced 71 DAP before disease was observed in the trial, it has potential as a protectant fungicide. When compared to treatments 4 and treatments 5, the initial application of chlorothalonil was sprayed 93 days after planting. This coincided with the first signs of disease. Since chlorothalonil is also a protectant fungicide, with no curative ability, it is possible that it showed lower efficacy for the control of soybean rust. In addition, results from previous fungicide trials conducted at Cedara indicated that the use of azoxystrobin has a lower efficacy when applied when disease is already present.

The addition of PREV-AM® to the chlorothalonil/azoxystrobin spray programme improved yield significantly. The sole PREV-AM® treatments were similar to sole chlorothalonil/azoxystrobin fungicide applications. Although not significantly different the use of PREV-AM® at 0.8% was the next best yield obtained after the standard control with PREV-AM®.

The weather conditions during the 2004/2005 season were characterised by warm moist weather, highly conducive for disease development. Since initial disease levels were low, despite favourable conditions, the trial was inoculated twice to increase inoculum levels. In addition, the trial had 6 rows for the plot with only the centre two rows per plot sprayed. This had the effect of increasing inoculum pressure as in effect each plot was surrounded by 4 unsprayed rows on either side. Thus, results obtained in this trial are reflective of the performance of the products under high inoculum levels. In addition the high rainfall received in the January to April period accelerated the epidemic at the end of March and early April.

It appears that the spray treatments reduced sporulation of the pathogen as a test was conducted to determine spore survival 24 hours after the last spray application of all treatments (129 DAP) was applied. This was to determine the effect of the product in a field situation. The trial could not be completed as there were not enough spores present in the pustules on the leaves of the treated plots, including the PREV-AM® plots, to test, compared to the UTC, where large amounts were present.
INTRODUCTION

Soybeans, Glycine max (L.) Merrill. are grown from temperate to tropical regions of the world, with production being highest in the United States, Brazil and China. Due to an increased production throughout the world, diseases that affect this crop have also therefore increased in number and severity. Soybeans are affected by more than 100 pathogens, with approximately 35 of economic importance.

Soybean rust, caused by Phakopsora pachyrhizi H. & P. Sydow, is one of the major diseases limiting soybean yield and has the potential for severe yield losses and is therefore considered as the most destructive foliar disease of soybeans. Yield losses of 50-60% are common if uncontrolled, as well as complete crop losses where early infection and favourable environmental conditions exist. Rust epidemics are most severe during extended periods of leaf wetness when the average daily temperature is less than 28°C and relative humidities vary between 75-80%. Moisture on plant surfaces is crucial for germination to occur, hence areas where prolonged periods of leaf wetness due to dew, mist and light rain occur provide optimum conditions for germination.

Control measures include chemical, biological and cultural control and resistance/tolerance. More recently, research investigating the efficacy of organic fungicides is being carried out. An *in vitro* study was conducted to determine the effect of PREV-AM®, on the germination of *P. pachyrhizi* spores.

MATERIAL AND METHODS

Germination trials were carried out to determined the effect of PREV-AM® on the germination of *P. pachyrhizi* spores. Sixteen combinations of PREV-AM® concentrations (0.1, 0.2, 0.4 and 0.8%) and exposure times (5, 10, 15 and 30min) were tested to determine their effect on uredospore germination.

Inoculum production
An early planting (trap-crop) of soybean plants grown at the KwaZulu-Natal Department of Agriculture and Environmental Affairs, Cedara (29°32'S, 30°17'E) in the 2004/2005 soybean growing season were used. Infection took place naturally by wind-blown *P. pachyrhizi* uredospores. Young (green) leaves from the top of plants were collected at the R3 growth stage.
Uredospore inoculation
Uredospores were collected from the abaxial leaf surface of infected leaves using a damp camel-hair paintbrush and placed in distilled water in a McCartney bottle. The concentration of a sample of this suspension was determined using a haemocytometer, and adjusted to $3.5 \times 10^5$ spores/ml.

Petri dishes containing 1.5% water agar, amended with 0.1, 0.2, 0.4 and 0.8% PREV-AM®, were used as ‘exposure’ media, and unamended 1.5% water agar plates as the germination media. Plates were prepared 24hrs before inoculation and placed in an incubator set at 21°C, together with McCartney bottles, micropipette tips and glass rods. A 150µl sample of the suspension was pipetted onto the amended water agar plates and spread using a glass rod.

Uredospore treatments
Sixteen combinations of PREV-AM® concentration (0.1, 0.2, 0.4 and 0.8%) and exposure time (5, 10, 15 and 30min) were tested. As the control, 150µl of spore suspension was pipetted directly onto unamended 1.5% water agar plates and incubated for 9hrs at the optimum temperature. Each treatment was replicated five times. Once uredospores were inoculated onto their relevant amended plates, the Petri dishes were sealed with Parafilm® and placed in an incubator set at 21°C. After the specified exposure time had lapsed, uredospores were washed off the amended plates onto unamended 1.5% water agar plates using 1ml distilled water. These plates were sealed with Parafilm® to prevent humidity changes and once again incubated at 21°C for a further 9hrs. Based on studies conducted at the University of KwaZulu-Natal, Pietermaritzburg optimal temperature for uredospore germination was 21°C with a leaf wetness duration of 9hrs.

Uredospore counts
Spores were considered germinated when the germ tube was as long as or longer than the diameter of the uredospore. Uredospores (50-100) on the Petri dishes were counted using a compound microscope (100x) immediately after removing plates from the incubator. Average percentage germination was calculated for each treatment.

Statistical analysis
Results were statistically analysed using analysis of variance (ANOVA) on the average percentage germination using Genstast Version 6.1. The least significant difference (LSD) was used to determine the significance of differences between treatments.

RESULTS
The general trend was a decrease in germination percentage with an increase in concentration of PREV-AM®, and similarly a decrease in germination percent was seen with an increased exposure time. There was a significant difference between the control and all the treatments. Total inhibition of germination occurred with a 0.8% PREV-AM® concentration with an exposure time of 30 minutes (Table 1, Fig 1 and 2), however there was not significant difference between 0.8% concentration at 30 minute exposure and 0.8% concentration at 15 minute exposure.

Table 1. Average percentage uredospore germination for different combinations of PREV-AM® concentrations and exposure times of the uredospores.

<table>
<thead>
<tr>
<th>Exposure time (minutes)</th>
<th>Concentration (%)</th>
<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
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<tr>
<td></td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>0</td>
<td>82.4*</td>
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<tr>
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<td>57.6 dfg</td>
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* treatments with the same letter are not significantly different at $P = \leq 0.05$  
LSD = 14.90; CV% = 24.6
Germination of Asian Soybean Rust uredospores after exposure to OSA-SAPAE04002 concentrations in petri dish for time periods indicated (South Africa).

Fig. 1. Effect of concentration and exposure time on percentage uredospore germination.

Fig. 2. Analysis of variance (ANOVA) of the effect of concentration of PREV-AM® and exposure time on the percentage uredospore germination.

* treatments with the same letter are not significantly different at $P \leq 0.05$

LSD = 14.90; CV% = 24.6
With light microscopy, some uredospores, exposed to a 0.8% concentration of PREV-AM® for 5 minutes, showed signs of initial stage of development of a germ tube.

![Image of uredospores showing germ tube development](image.png)

**Fig. 3.** Light microscopy showing the beginning of the formation of a germ tube after exposure a 0.8% concentration of PREV-AM® for 5 minutes.

**DISCUSSION**

Although a general trend was observed, inconsistencies were noted. During the inoculation of the amended plates, the 10 and 30 minute exposure time plates were inoculated in a batch, incubated, rinsed and unamended plates placed in an incubator before the following batch of 5 and 15 minute exposure time plates were inoculated and prepared. The time lapse between the preparation of the two ‘batches’ was approximately 40 minutes. Since the same spore suspension was used for all inoculations, the time delay could have resulted in the germination process of the uredospores being initiated while in suspension before exposure to PREV-AM®. It is therefore likely, that some of the spores that were counted as germinated (spores were considered germinated when the germ tube was a long as or longer than the diameter of the uredospore) after exposure, had possibly germinated before exposure. This would explain the higher germination rates for the 5 and 15 minute exposure time at all concentration.

These results, however, do show potential of the product as a fungicidal product. It is therefore encouraged that further tests be conducted to explore these properties and opportunity be given to ‘fine-tune’ the experimental procedure for more accurate results. This will also allow for further light microscopy studies to be undertaken.
1. How does PREV-AM® work?

PREV-AM® is a blend of Borax®, orange oil and organic surfactants. The blend enables highly effective distribution of the active ingredient, Borax®. The active ingredient (AI) disrupts the outer layer of the organism resulting in various effects all within 24 to 48 hours, often in as little as a few minutes after drying.

As a FUNGICIDE: The PREV-AM solution wets the protective membrane of the fungal mycelia, sporangia, and spores, breaking it down and exposing them to the drying effect of the atmosphere. Drying of the fungal mycelia and the surrounding leaf tissue will prevent further spread of infection. Plant tissue damaged by the fungus may also dry out, but healthy tissue will not be affected.

As an INSECTICIDE: Soft-bodied insects are protected by a water repellent layer that loses its effectiveness when PREV-AM comes into contact with it. The insects are then exposed to loss of body fluids causing death. Flying insects experience loss of the protective coverings and tension in the wings, making them unable to fly. Another effect on some insects is the penetration of the ultra low surface tension fluid into the respiratory organs causing suffocation.

As TANK MIX EFFICACY PARTNER: PREV-AM contains highly effective ADJUVANT properties that not only benefits PREV-AM’s active ingredient but is also proven to enhance systemic, translaminar and foliar nutrient products efficacy. (PREV-AM’s adjuvancy technical sheet available from Oro Agri)

As IPM TOOL: As a contact kill, NON-systemic product, PREV-AM benefits predators and pollinators.

As COST MANAGEMENT TOOL: In a systemic or translaminar tank mix, the contact kill ability enables the grower more application-time and dosage-strength flexibility with potential overall cost saving.

As RESISTANCE MANAGEMENT TOOL: The MOA of PREV-AM is different than most products on the market. When combined with other products, PREV-AM enables growers to attack disease and insects with multiple modes-of-action to minimize resistance issues.

2. How long does it take for PREV-AM to work?

PREV-AM is a contact performance product. Field evaluation should be done within 24 to 48 hours after application.

3. How long will PREV-AM last in controlling insects and diseases?

PREV-AM is a contact performance product with no systemic or translaminar performance. PREV-AM’s pesticidal effect occurs at the time of contact with the insect or disease. It is therefore essential that good coverage be obtained. It is recommended that PREV-AM be used in conjunction with other systemic and translaminar products in the same tank mix. PREV-AM is positioned to be the immediate broad spectrum knockdown. When used as part of a standard tank mix program PREV-AM will help control targeted insect and disease outbreaks AND also help control multiple other rising insect and diseases colonies before they become an apparent problem.

4. Why use Orange Oil?

Orange oil is derived from the peels of oranges and is used in products as flavourings, fragrances and cosmetics. We use orange oil in conjunction with other biodegradable surfactants to attain highly effective surface tension reduction at very low dosage rates. The orange oil also provides a pleasant fragrance.

5. How much PREV-AM do I use?

Always use the label for guidance. General use rate is 0.4% solution by volume or 50 oz per 100 gallons of water. As allowed per the label, tougher diseases and insects may require dosages up to as much as 0.8% solution by volume or 100 oz per 100 gallons.

6. How much water-solution (PREV-AM in water) per acre should I use?

PREV-AM should initially be used in the Grower/Consultant standard water volume per acre. As a contact performance product, sufficient coverage should be ensured to cover the insects and diseases. Most other foliar pesticides also require effective foliar distribution to work properly. Given the surface tension reduction properties of PREV-AM, tank-mix solution volume reduction of 20 to 30% is not uncommon. With PREV-AM solution applications as low as 5 gallons per acre on seedling crops to as high as 100 gallons per acre on permanent crops have been used. The key factor however remains effective coverage which is determined by the efficacy of the application method used and the size of the crop at the time of application.
7. What type of application equipment can be used?

PREV-AM is formulated to be used in virtually all common agricultural spray applications. Very little tank agitation is required. Spray nozzle selection and orientation are critical to product effectiveness. Boom design needs to effectively cover the outer and inner canopy of the plant to ensure that the tank mix solution come into contact with the insects and diseases. Air assisted spray rigs may help improve spray solution efficiency and kill efficacy. Electrostatic applications have been used however very little efficacy studies have been done on this type of application technology.

8. Can I tank mix PREV-Am with other materials?

PREV-AM is typically used with numerous tank mix products but not all. If the user is aware or uncertain of materials that may have increased phyto-toxicity risk, then PREV-AM should not be used. As recommended with most chemicals, always test a small area to minimize phyto-toxicity potential risk. PREV-AM may also be used with other products that may have little or no contact activity.

9. Does PREV-AM provide any boron nutrition to the plant since it contains Borax®?

Tests have revealed that PREV-AM does not measurably increase the boron concentration in plants.

10. Where can I get PREV-AM?

ORO AGRI has selected distribution partners in virtually all areas of the US. Visit www.orogri.com or email us at info@oroagri.com to locate the closest product supplier in your area. (Additionally, you can also call 503-819-4950 or 877-773-8268 for more info).

11. How is PREV-AM packaged?

PREV-AM comes standard in 2 x 2 ½ gallon cases. PREV-AM is also available on special orders in 30 gallon drums.

12. What does PREV-AM cost?

PREV-AM has a suggested Grower price of $60 per gallon. Prices may vary depending on regions, taxes, concentration used (typically 0.4%) and the volume of solution applied per acre. In many cases the volume of water has been reduced given the improved surface tension characteristics of the product. At a suggested retail price of $60/gal and 50 oz/100 gallons rate, at 20 GPA water, the cost of PREV AM is only $5.00/acre!!!!

13. Is PREV-AM safe?

PREV-AM has a favourable toxilogical profile. EPA’s review of PREV-AM resulted in the product being exempt from tolerance, 12 hour PHI (Post Harvest Intervals), 12 hour REI (re-entry interval), no special Worker Protection Safety requirements (WSP).

14. What life stages of insects and diseases does PREV-AM affect?

PREV-AM has demonstrated biological efficacy on many life stages of insects and diseases due to its physical mode of action. In insects, PREV-AM has demonstrated control on contact of eggs, nymphs, larvae, winged adults and worms. In diseases, PREV-AM has demonstrated control on contact of spores, mycelia, etc. Certain life stages are easier to reach and the rate of success is therefore dependent on the success of application procedures.

15. Does rainfall or overhead irrigation affect PREV-AM results?

PREV-AM acts on contact of insects and diseases and response time is quick. Once the spray has dried, PREV-AM insecticidal and fungicidal activity is complete. Good practices should however be followed when using PREV-AM if rain or irrigation is planned or expected.

16. Is PREV-AM organic?

PREV-AM is Exempt From Tolerance. PREV-AM is currently not approved by the USDA 100% organic standard.

17. Can I use lower rates of other products when I am using PREV-AM?

ORO AGRI recommends following label directions and local recommendations for rates and timings of other materials. In addition to contact performance, PREV-AM has highly effective surface tension reduction and coverage improvement capabilities which may enhance the performance of a large percentage of other products when combined in tank mixes. PREV-AM will control upon contact a broad spectrum of other non targeted insects and diseases before they are detected or become problematic. This effect may lower demand of other systemic or transaminar products.

18. Does PREV-AM help with resistance management?

PREV-AM’s mode of action and effect on various life stages is different than many chemicals currently used. Check with local extension agents or experts in resistance management. ORO AGRI believes and recommends that PREV-AM be used in combination and / or rotation with other synthetic chemicals to form part of an effective resistance management spray program.

19. Does PREV-AM have other benefits?

PREV-AM has no residual insecticidal properties. This allows beneficial insect populations to rebuild effectively following the use of PREV-AM.
Features and benefits

Miticide, Insecticide, Fungicide – A contact pesticide to gain immediate control over pests with no residue to harm beneficial predators or pollinators

Ultra Low Surface Tension Adjuvant - To help pesticide to penetrate to difficult-to-reach places

Wetting - Overcomes repellent waxy protection on plants

Spreading - Spray application is spread more evenly over the plant surface

Prevents re-congregation of droplets on foliage - Allows for more even spread of pesticide and nutrients after drying

Penetrates pest's water repellent protection mechanisms - Allows accompanying pesticide to penetrate into pest's living tissues, foliage cuticles and into dense foliage area

Cleans spray nozzles and prevents clogging

As wetter

PREV-AM® has an ultra-low surface tension with excellent wetting and spreading characteristics on plants and pests. The orange oil in the formulation constitutes the wax/fat-bonding component that interacts with waxes and fats.

The very powerful surfactant package in the formulation makes up the water-bonding component. The combined action of the orange oil and surfactants in PREV-AM® makes it extremely effective in overcoming the water repellent protective mechanisms of pests, allowing the active ingredients of the accompanying pesticide and nutrients that is dissolved in the water to penetrate to the tissue of pests and foliage.

Surface Tension for different concentrations of PREV-AM® in distilled water at 25 deg. C.

Strelitzia reginae leaf sprayed with 0.05% PREV-AM® showing even wetting and penetration of the leaf surface and no re-congregation of droplets
As spreader

Wetting of citrus leaves with PREV-AM® at 0.1% (100 ml/100litre)

As penetrant

Hairy caterpillar’s full weight being suspended by the surface tension of the water.

Wetting of citrus leaves with industry standard mineral oil at (300ml/100litre)

The same caterpillar in a solution of 0.05% PREV-AM®. The low surface tension results in it sinking and being totally wetted.