

TRANSLATION CERTIFICATION

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To whom it may concern:

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- **Portuguese**

To:

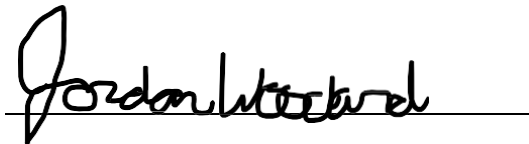
- **English**

The document is designated as:

Godoy et al., "Eficiência de fungicidas multissítios no controle da ferrugem-asiática da soja, *Phakopsora pachyrhizi*, na safra 2015/16: resultados sumarizados dos ensaios cooperativos", Londrina, PR Agosto 2016 (Embrapa Soja, Circular Técnica, 121)

Jordan Woodard, Project Manager in this company, attests to the following:

"To the best of my knowledge, the aforementioned document is a true, full and accurate translation of the specified document."



Signature of Jordan Woodard

Londrina, PR
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Authors

Cláudia V. Godoy, D.Sc.
Agricultural Engineer,
Embrapa Soja, Londrina, PR.

Carlos M. Utimada
Agricultural Engineer,
TAGRO,
Londrina, PR.

Maurício C. Meyer, D.Sc.
Agricultural Engineer,
Embrapa Soybean,
Londrina, PR.

Hercules D. Campos, D.Sc.
Agricultural Engineer, UniRV,
Rio Verde, GO.

Carlos A. Forcelini, Ph.D.
Agricultural Engineer,
University of Passo Fundo,
Passo Fundo, RS.

Cláudia B. Pimenta, M.Sc.
Agricultural Engineer,
Emater-GO,
Goiânia, GO.

David S. Jaccoud Filho, Ph.D.
Biologist, Agricultural Engineer,
State University of Ponta
Grossa, Ponta Grossa, PR.

Efficiency of multisite fungicides in controlling Asian soybean rust, *Phakopsora pachyrhizi*, in the 2015/16 harvest: summarized results of cooperative trials

The diseases that affect the soybean crop represent one of the main threats to productivity and national competitiveness. Annual production losses due to diseases are estimated at around 15 % to 20 % (TECNOLOGIAS, 2013). The use of fungicides to control diseases in the crop began with the epidemic outbreak of powdery mildew (*Microsphaera diffusa*), in the 1996/97 harvest. Subsequently, the increase in the incidence of end-of-cycle diseases (*Septoria glycines* and *Cercospora kikuchii*), mainly due to intensive cultivation and the lack of crop rotation, also demanded registration of fungicides (TECNOLOGIAS, 2013). With the emergence of Asian soybean rust (*Phakopsora pachyrhizi*) in Brazil in 2001 (YORINORI et al., 2005), new products were registered. Among other diseases also controlled by fungicides, we can mention target spot (*Corynespora cassicola*), anthracnose (*Colletotrichum truncatum*), white mold (*Sclerotinia sclerotiorum*) and rhizoctonia root rot (*Rhizoctonia solani* AG1).

Among the main modes of action used to control diseases in soybean crops, the most common ones are the site-specific fungicides methyl benzimidazole carbamate (MBC), demethylation inhibitors (DMI), quinone oxidase inhibitors (QoI) and succinate dehydrogenase inhibitors (SDHI). Despite the great contribution that site-specific fungicides provide in disease control, their intensive use may result in the selection of less sensitive or resistant fungal isolates. Populations of the fungus *C. cassicola* resistant to MBC (XAVIER et al., 2013) and *P. pachyrhizi* less sensitive to DMI and QoI have been reported (SCHMITZ et al., 2014; KLOSOWSKI et al., 2016).

The limited number of different modes of action of fungicides available to control diseases in soybeans crops, associated with less sensitive populations of fungi already observed in the field and the low efficiency of isolated active ingredients, make it difficult to use resistance management strategies such as the rotation of modes of action. Evaluating the efficiency of fungicides with different modes of action is essential to increase disease control options in soybeans crops. The use of multisite fungicides can be an option for both Asian soybean rust control and an anti-resistance strategy.

The objective of this work is to present the summarized results of cooperative trials with multisite fungicides, carried out on 2015/16 harvest, to control diseases in soybeans crops.

Material and Methods

With the objective of evaluating the efficiency of multisite fungicides, isolated and associated, two protocols were carried out in the 2015/16 harvest, by 19 institutions in 23 locations (Table 1).

Table 1. Soybean sowing institutions, locations, and dates.

Institution	City, State	Sowing
1 Embrapa Soja	Londrina, PR	11-23-2015
2 Agricultural Research Center Copacol	Cafelândia, PR	10-15-2015
3 AgroCarregal Plant Research and Protection	Rio Verde, GO	12-9-2015
4 Instituto Biológico	Paulínia, SP	11-10-2015
5 Instituto Mato-Grossense do Algodão	Primavera do Leste, MT	12-18-2015
6 UniRV	Rio Verde, GO	12-7-2015
7 CWR Pesquisa Agrícola	Palmeira, PR	12-9-2015
8 Phytus Institute	Itaara, RS	12-1-2015
9 Fundação Mato Grosso	Primavera do Leste, MT	11-19-2015
10 Agrodinâmica Cons. e Pesquisa Agropecuária	Deciolândia, MT	1-3-2016
11 Agrodinâmica Cons. e Pesquisa Agropecuária	Campos Novos dos Parecis, MT	12-16-2015
12 Federal University of Uberlândia	Uberlândia, MG	11-27-2015
13 Fundação Chapadão	Chapadão do Sul, MS	11-19-2015
14 Fundação Mato Grosso	Campo Verde, MT	11-17-2015
15 Fundação Mato Grosso	Nova Mutum, MT	11-16-2015
16 Fundação Mato Grosso	Pedra Preta, MT	12-3-2015
17 State University of Ponta Grossa	Ponta Grossa, PR	12-2-2015
18 Círculo Verde Agronomic Consultancy and Research	Luís Eduardo Magalhães, BA	12-16-2015
19 The University of Passo Fundo	Passo Fundo, RS	11-30-2015
20 CTPA/ Emater	Senador Canedo, GO	12-22-2015
21 CTPA/ Emater	Senador Canedo, GO	12-30-2015
22 TAGRO	Mauá da Serra, PR	12-17-2015
23 Dalcin Consultoria	Nova Xavantina, MT	12-4-2015

The first protocol was carried out with the isolated multisite fungicides (Table 2) and the second one with the products used in association with the fungicides picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹ (Aproach®Prima, DuPont) and azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹ (Elatus®, Syngenta) (Table 3). The associated products protocol was not carried out at location 10 (Deciolândia, MT).

The list of treatments (Tables 2 and 3), the experimental design and the evaluations were defined with a single protocol, for the joint summarization of the results of the trials. The fungicides of treatments 2, 5, 6, 9, 10 and 13 (Table 2) are registered in MAPA (ministry of agriculture, livestock, and food supply) for the control of *Cercospora kikuchii* (treatments 5, 6 and 13), *Septoria glycines* (treatments 2, 5, 6, 10 and 13), *Corynespora cassiicola* (treatments 5, 6 and 13), *Phakopsora pachyrhizi* (treatment 13), *Sclerotinia sclerotiorum* (treatment 9), *Microsphaera diffusa* (treatment 13), *Rhizoctonia solani* (treatment 13) and *Peronospora manshurica* (treatment 10). The fungicides of treatments 3, 4, 8, 11 and 12 have Temporary Special Registration (RET) III. Fungicides from treatments 2 to 12 present RET for the biological target *P. pachyrhizi*.

Edson R. de Andrade Junior, M.Sc.
Agricultural Engineer,
Instituto Mato-Grossense do Algodão,
Cuiabá, MT.

Edson P. Borges, M.Sc.
Agricultural Engineer,
Fundação Chapadão,
Chapadão do Sul, MS.

Fabiano V. Siqueiri
Agricultural Engineer,
Fundação Mato Grosso,
Rondonópolis, MT.

Fernando C. Juliatti, D.Sc.
Agricultural Engineer,
Federal University of Uberlândia,
Uberlândia, MG.

Fernando Favero
Agricultural Engineer,
Agricultural Research Center Copacol,
Cafelândia, PR.

Ivan Pedro Araújo Júnior
Agricultural Engineer,
Fundação Mato Grosso,
Rondonópolis, MT.

José Nunes Junior, D.Sc.
Agricultural Engineer,
Technological Center for
Agricultural Research (CTPA),
Goiânia, GO.

Luis Henrique C. P. da Silva, M.Sc.
Agricultural Engineer,
Agro Carregal Plant Research
and Protection,
Rio Verde, GO.

Luiz Nobuo Sato
Agricultural Engineer,
TAGRO,
Londrina, PR.

Marcelo R. Volf, M.Sc.
Agricultural Engineer,
Dalcin Serviços Agropecuários,
Nova Xavantina, MT.

Mônica Paula Debortoli, D.Sc.
Agricultural Engineer,
Phytus Institute,
Santa Maria, RS.

Mônica C. Martins, D.Sc.
Agricultural Engineer,
Círculo Verde Agronomic
Consultancy and Research,
Luís Eduardo Magalhães, BA.

Ricardo S. Balardin, Ph.D.
Agricultural Engineer,
Phytus Institute,
Santa Maria, RS.

Silvânia H. Furlan, D.Sc.
Agricultural Engineer,
Instituto Biológico,
Campinas, SP.

Tiago Madalosso, M.Sc.
Agricultural Engineer,
Agricultural Research Center Copacol,
Cafelândia, PR.

Valtemir J. Carlin
Agricultural Engineer,
Agrodinâmica,
Tangará da Serra, MT.

Wilson Story Venâncio, D.Sc.
Agricultural Engineer, CWR
Pesquisa Agrícola Ltda/
State University of
Ponta Grossa,
Ponta Grossa, PR.

Table 2. Active ingredient (a.i.), commercial product (C.P.) and dose of fungicides to control diseases in soybeans crops, 2015/16 harvest.

Treatments: Active ingredient (a.i.)	Dose g a.i. ha ⁻¹	Commercial product (C.P.)	Dose l-kg C.P. ha ⁻¹
1 control	-		
2 chlorothalonil	1080	Previni [®] , Helm	1.5
3 copper oxychloride	280	PNR ⁴ , Sapec Agro	0.4
4 copper oxychloride	560	PNR ⁴ , Sapec Agro	0.8
5 mancozebe ¹	1500	Unizeb Gold [®] , UPL	2.0
6 mancozebe ¹	1875	Unizeb Gold [®] , UPL	2.5
7 copper sulfate	113.85	PNR ⁴ , Nortox	0.75
8 propineb ²	1400	PNR ⁴ , Bayer	2
9 fluazinam ¹	500	Frownicide [®] /Zignal [®] , ISK/FMC	1
10 chlorothalonil	1000	Bravonil 500 [®] , Syngenta	2
11 chlorothalonil	1000	PNR ⁴ , Ourofino	2.0
12 mancozebe ¹	2000	PNR ⁴ , Nufarm	2.5
13 azoxystrobin+benzovindiflupyr ³	60+30	Elatus [®] , Syngenta	0.20

¹ Added Agris 0,5 %; ² Added Aureus 0,25 %; ³ Added Nimbus 0,6 l ha⁻¹; ⁴ PNR - Product not registered for the soybean crop - RET III.

Table 3. Active ingredients (a.i.), commercial product (C.P.) and dose of fungicides evaluated in associated treatments to control diseases in soybean crops, 2015/16 harvest.

Active ingredient (a.i.)	Dose g a.i. ha ⁻¹	Commercial product (C.P.)	Dose l-kg C.P. ha ⁻¹
1 control	-	Control	-
2 picoxystrobin + cyproconazole ¹	60+24	Aproach [®] Prima	0.3
3 picoxystrobin + cyproconazole ¹ and copper oxychloride	60+24 and 294	Aproach [®] Prima and Difere [®]	0.3 and 0.5
4 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1080	Aproach [®] Prima and Previni [®]	0.3 and 1.5
5 picoxystrobin + cyproconazole ¹ and copper oxychloride	60+24 and 280	Aproach [®] Prima and PNR ²	0.3 and 0.4
6 picoxystrobin + cyproconazole ¹ and mancozeb	60+24 and 1500	Aproach [®] Prima and Unizeb Gold [®]	0.3 and 2.0
7 picoxystrobin + cyproconazole ¹ and copper sulfate	60+24 and 113,85	Aproach [®] Prima and PNR ²	0.3 and 0.75
8 picoxystrobin + cyproconazole ¹ and propineb	60+24 and 1400	Aproach [®] Prima and PNR ²	0.3 and 2.0
9 picoxystrobin + cyproconazole ¹ and fluazinam	60+24 and 500	Aproach [®] Prima and Frownicide [®] /Zignal [®]	0.3 and 1.0
10 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1000	Aproach [®] Prima and Bravonil 500 [®]	0.3 and 2.0
11 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1000	Aproach [®] Prima and PNR ²	0.3 and 2.0
12 picoxystrobin + cyproconazole ¹ and mancozeb	60+24 and 2000	Aproach [®] Prima and PNR ²	0.3 and 2.5
13 azoxystrobin + benzovindiflupyr ¹	60+30	Elatus [®]	0.2
14 azoxystrobin + benzovindiflupyr ¹ and copper oxychloride	60+30 and 294	Elatus [®] and Difere [®]	0.2 and 0.5
15 azoxystrobin + benzovindiflupyr ¹ and chlorothalonil	60+30 and 1080	Elatus [®] and Previni [®]	0.2 and 1.5
16 azoxystrobin + benzovindiflupyr ¹ and copper oxychloride	60+30 and 280	Elatus [®] and PNR ²	0.2 and 0.4
17 azoxystrobin + benzovindiflupyr ¹ and mancozeb	60+30 and 1500	Elatus [®] and Unizeb Gold [®]	0.2 and 2.0
18 azoxystrobin + benzovindiflupyr ¹ and copper sulfate	60+30 and 113,85	Elatus [®] and PNR ²	0.2 and 0.75
19 azoxystrobin + benzovindiflupyr ¹ and propineb	60+30 and 1400	Elatus [®] and PNR ²	0.2 and 2.0
20 azoxystrobin + benzovindiflupyr ¹ and fluazinam	60+30 and 500	Elatus [®] and Frownicide [®] /Zignal [®]	0.2 and 1.0
21 azoxystrobin + benzovindiflupyr ¹ and chlorothalonil	60+30 and 1000	Elatus [®] and Bravonil 500 [®]	0.2 and 2.0
22 azoxystrobin + benzovindiflupyr ¹ and chlorothalonil	60+30 and 1000	Elatus [®] and PNR ²	0.2 and 2.0
23 azoxystrobin + benzovindiflupyr ¹ and mancozeb	60+30 and 2000	Elatus [®] and PNR ²	0.2 and 2.5

¹ Added Nimbus 0,6 l ha⁻¹; ² PNR – Product not registered for the soybean crop, RET III.

The experimental design was randomized blocks with four replications. Each replication consisted of plots with at least six rows of five meters each. The applications started in the pre-closing of the sowing lines and the two protocols were carried out in the same area in each location, with the exception of location 10, where only the test with isolated protectors was carried out.

In the first protocol (Table 2) five applications were carried out, with an average interval of 10 days between the first and second application, 11 days between the second and third and 10 days between the third and fourth and the fourth and fifth application. For treatment 13 (azoxystrobin + benzovindiflupyr) three applications were carried out with average intervals of 21 and 14 days after the first and second application, respectively.

In the second protocol (Table 3) three applications were carried out with average intervals of 21 and 15 days after the first and second application, respectively.

To apply the products, a knapsack sprayer pressurized with CO₂ and a minimum application volume of 120 L ha⁻¹ was used.

It was carried out evaluations of the severity and/or incidence of diseases at the time of application of the products; of the severity periodically and after the last application; of defoliation when the control showed around 80 % of defoliation; of productivity in a minimum area of 5 m² in the center of each plot and the weight of 1000 grains.

For the joint analysis, severity assessments were used, carried out between the phenological stages R5 (beginning of grain filling) and R6 (pods with 100 % graining) and productivity.

Exploratory analyzes of variance were carried out for each location. In the individual analyses, the following were observed: the residual mean square, the coefficient of variation, the asymmetry coefficient, the kurtosis coefficient, the normality of the distribution of residues (SHAPIRO; WILK, 1965), the additivity of the statistical model (TUKEY, 1949) and the homogeneity of treatment variances (BURR; FOSTER, 1972).

Tukey's test of multiple comparisons of means ($p=0.05$) was applied to the joint analysis, in order to obtain groups of treatments with similar effects. All analyzes were carried out in routines generated in the SAS® program, version 9.1.3. (SAS/ STAT, 1999).

Results and Discussion

The common disease in the trials and which it was possible to carry out joint summarization was Asian soybean rust (*P. pachyrhizi*). In the test location 23 there was no incidence of rust. At the time of the first application of the treatments, of the 23 trials, five showed symptoms of rust (locations 4, 14, 16, 19 and 22).

In the protocol with the application of isolated products, the lowest severity was observed for the treatment with three applications of azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹ (T13 – 19.4 %) (Table 4). Among the multisite, the lowest severity was observed for the treatment with mancozeb 2000 g a.i. ha⁻¹ (T12 – 25.8 %), followed by treatments with mancozeb 1875 g a.i. ha⁻¹ (T6 – 28 %), mancozeb 1500 g a.i. ha⁻¹ (T5 – 34.1 %) and chlorothalonil 1080 g a.i. ha⁻¹ (T2 – 34.3 %), with percentage of control ranging from 56 % to 67 % in relation to the control treatment.

The correlation (r) of the severity variable with productivity was -0.98 ($p<0.001$). The highest productivity was observed for the treatment with three applications of azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹ (T13 – 3257 kg ha⁻¹). Among the multisite, the highest productivity was observed for treatments with mancozeb 2000 g a.i. ha⁻¹ (T12 – 3062 kg ha⁻¹) and mancozeb 1875 g a.i. ha⁻¹ (T6 – 3004 kg ha⁻¹), followed by mancozeb 1500 g a.i. ha⁻¹ (T5 – 2920 kg ha⁻¹) and chlorothalonil 1080 g a.i. ha⁻¹ (T2 – 2900 kg ha⁻¹).

In the joint analysis of the protocol trials with the association of protectors, location 21 was eliminated for the severity variable due to the late evaluation in relation to the last application. The severity of all treatments was lower than that of the control without control (T1 – 78.5 %). For treatments with applications associated with picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹, there was a significant reduction in severity with the

association of multisite in all combinations. The lowest severity was observed for the association with mancozeb 2000 g a.i. ha⁻¹ (T12 – 29.2 %), followed by chlorothalonil 1080 g a.i. ha⁻¹ (T4 – 31.6 %), mancozeb 1500 g a.i. ha⁻¹ (T6 – 31.6 %) and copper oxychloride 294 g a.i. ha⁻¹ and 280 g a.i. ha⁻¹ (T3 and T5 – 32.9 %). Despite the significant reduction in severity with the associated application, no treatment with picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹ showed a reduction in severity similar to treatment with azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹ isolated (T13 – 18.3 %).

For applications associated with the fungicide azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹, only associations with mancozeb 2000 and 1500 g a.i. ha⁻¹ (T23 – 15 %; T17 – 15.2 %), copper oxychloride 294 g a.i. ha⁻¹ (T14 – 15.2 %), chlorothalonil 1080 g a.i. ha⁻¹ (T15 – 15.6 %) and copper oxychloride 280 g a.i. ha⁻¹ (T16 – 16.4 %) differed statistically from the isolated application.

The correlation (*r*) of the severity variable with productivity was -0.97 (*p* < 0.001). All treatments showed statistically higher productivity than the control without control (Table 5). For the applications associated with the fungicide picoxystrobin + cyproconazole, the associations with copper sulfate 113.85 g a.i. ha⁻¹ (T7 – 2737 kg ha⁻¹), propineb 1400 g a.i. ha⁻¹ (T8 – 2750 kg ha⁻¹) and fluazinam 500 g a.i. ha⁻¹ (T9 – 2711 kg ha⁻¹) did not differ significantly from treatment with picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹ without association (T2 – 2654 kg ha⁻¹). The highest productivities were observed for associations with mancozeb 2000 g a.i. ha⁻¹ and 1500 g a.i. ha⁻¹ (T12 – 2932 kg ha⁻¹; T6 – 2876 kg ha⁻¹, respectively), chlorothalonil 1080 g a.i. ha⁻¹ and 1000 g a.i. (T4 – 2876 kg ha⁻¹; T11 – 2841 kg ha⁻¹, respectively) and copper oxychloride 294 g a.i. ha⁻¹ (T3 – 2823 kg ha⁻¹). Despite the significant increase in productivity with the associated application, the productivity of any treatment with picoxystrobin + cyproconazole 60 + 24 g a.i. ha⁻¹ was equal to treatment with azoxystrobin + benzovindiflupyr 60 + 30 g a.i. isolated ha⁻¹ (T13 – 3186 kg ha⁻¹).

For applications associated with fungicide azoxystrobin + benzovindiflupyr 60 + 30 g a.i. ha⁻¹, the highest productivities were observed for treatments with associations of mancozeb 1500 g a.i. ha⁻¹ and 2000 g a.i. ha⁻¹ (T17 – 3377 kg ha⁻¹; T23 – 3270 kg ha⁻¹, respectively), although the productivity of the association with mancozeb 2000 g a.i. ha⁻¹ was statistically similar to azoxystrobin + benzovindiflupyr 60 + 30 g a.i. isolated ha⁻¹ (T13 – 3186 kg ha⁻¹).

The efficiency with the best multisite fungicides, with five applications, ranged from 56 % to 67 % (Table 4). Among the different fungicides with the same active ingredient (mancozeb, chlorothalonil and copper oxychloride), a reduction in severity was observed with an increase in the dose of the active ingredient.

In the applications associated with the site-specific fungicide Aproach®Prima, which alone presented 44 % of control, all multisite significantly increased the control, with a maximum of 63 % for the association with mancozeb 2000 g a.i. ha⁻¹ (Table 5). However, despite the significant increase in control, not all fungicides provided a significant increase in productivity.

For the fungicide Elatus®, which alone presented 77 % of control, the gains in control in the associations were lower than those observed for the fungicide Aproach®Prima, with a maximum control of 81 % observed for the associations with mancozeb 2000 g a.i. ha⁻¹ and 1500 g a.i. ha⁻¹ and copper oxychloride 294 g a.i. ha⁻¹. Similarly, the productivity increments were not significant for the associations, with the exception of mancozeb 1500 g a.i. ha⁻¹.

The results of this work are from research and should not be used as a recommendation in the field. With the exception of the fungicides Aproach®Prima and Elatus®, the others are not registered in MAPA for the control of *P. pachyrhizi*.

Multisite fungicides can be an important tool in Asian soybean rust management

programs, requiring MAPA registration for their use.

Table 4. Rust severity, percentage of control (C) in relation to the control without fungicide, productivity, and percentage of productivity reduction (PR) in relation to the treatment with the highest productivity, for the different treatments. Average of 22 trials. 2015/16 harvest.

Treatment Active ingredient (a.i.)	Dose g a.i. ha ⁻¹	Severity (%)	C (%)	Productivity kg ha ⁻¹	PR (%)
1 control	-	77.5 A	0	2120 I	35
2 chlorothalonil	1080	34.3 E	56	2900 DE	11
3 copper oxychloride ⁴	280	46.5 B	40	2604 H	20
4 copper oxychloride ⁴	560	39.8 C	49	2692 GH	17
5 mancozebe ¹	1500	34.1 E	56	2920 CD	10
6 mancozebe ¹	1875	28.0 F	64	3004 BC	8
7 copper sulfate ⁴	113.85	47.8 B	38	2610 H	20
8 propineb ^{2, 4}	1400	41.2 C	47	2664 H	18
9 fluazinam ¹	500	37.3 D	52	2770 FG	15
10 chlorothalonil	1000	39.9 C	48	2824 EF	13
11 chlorothalonil ⁴	1000	37.0 D	52	2806 F	14
12 mancozebe ^{1, 4}	2000	25.8 G	67	3062 B	6
13 azoxystrobin+benzovindiflupyr ³	60+30	19.4 H	75	3257 A	0
C.V. %		8.4		6.5	

Means followed by the same letter, in the column, do not differ according to Tukey's test ($p=0.05$). Added Agris 0.5 %; added aureus 0.25 %; added Nimbus 0.6 l ha⁻¹; 4PNR - Product not registered for soybean crops - RET III.

Table5. Rust severity, percentage of control (C) in relation to the control without fungicide, productivity, and percentage of productivity reduction (PR) in relation to the treatment with the highest productivity, for the different treatments. Average of 20 tests for severity and 21 for productivity. 2015/16 harvest.

Treatment Active ingredient (a.i.)	Dose g a.i. ha ⁻¹	Severity (%)	C (%)	Productivity kg ha ⁻¹	PR (%)
1 control	-	78.5 A	0	2175 I	36
2 picoxystrobin + cyproconazole ¹	60+24	43.8 B	44	2654 H	21
3 picoxystrobin + cyproconazole ¹ and copper oxychloride	60+24 and 294	32.9 DE	58	2823 DEF	16
4 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1080	31.6 E	60	2876 DE	15
5 picoxystrobin + cyproconazole ¹ and copper oxychloride ²	60+24 and 280	32.9 DE	58	2780 EFG	18
6 picoxystrobin + cyproconazole ¹ and mancozeb	60+24 and 1500	31.6 E	60	2876 DE	15
7 picoxystrobin + cyproconazole ¹ and copper sulfate ²	60+24 and 113,85	37.0 C	53	2737 FGH	19
8 picoxystrobin + cyproconazole ¹ and propineb ²	60+24 and 1400	36.1 C	54	2750 FGH	19
9 picoxystrobin + cyproconazole ¹ and fluazinam	60+24 and 500	34.1 D	57	2711 GH	20
10 picoxystrobin + cyproconazole ¹ and chlorothalonil	60+24 and 1000	33.8 D	57	2793 EFG	17
11 picoxystrobin + cyproconazole ¹ and chlorothalonil ²	60+24 and 1000	34.0 D	57	2841 DEF	16
12 picoxystrobin + cyproconazole ¹ and mancozeb ²	60+24 and 2000	29.2 F	63	2932 D	13
13 azoxystrobin + benzovindiflupyr ¹	60+30	18.3 G	77	3186 BC	6
14 azoxystrobin + benzovindiflupyr ¹ and copper oxychloride	60+30 and 294	15.2 JK	81	3195 BC	5
15 azoxystrobin + benzovindiflupyr ¹ and chlorothalonil	60+30 and 1080	15.6 IJK	80	3238 BC	4
16 azoxystrobin + benzovindiflupyr ¹ and copper oxychloride ²	60+30 and 280	16.4 HIJK	79	3147 C	7
17 azoxystrobin + benzovindiflupyr ¹ and mancozeb	60+30 and 1500	15.2 JK	81	3377 A	0
18 azoxystrobin + benzovindiflupyr ¹ and copper sulfate ²	60+30 and 113,85	16.8 GHIJ	79	3176 BC	6
19 azoxystrobin + benzovindiflupyr ¹ and propineb ²	60+30 and 1400	17.5 GH	78	3192 BC	5
20 azoxystrobin + benzovindiflupyr ¹ and fluazinam	60+30 and 500	17.5 GH	78	3205 BC	5
21 azoxystrobin + benzovindiflupyr ¹ and chlorothalonil	60+30 and 1000	16.8 GHIJ	79	3219 BC	5
22 azoxystrobin + benzovindiflupyr ¹ and chlorothalonil ²	60+30 and 1000	17.0 GHI	78	3224 BC	5
23 azoxystrobin + benzovindiflupyr ¹ and mancozeb ²	60+30 and 2000	15.0 K	81	3270 AB	3
C.V. %		10.5		6.6	

Means followed by the same letter, in the column, do not differ according to Tukey's test ($p=0.05$). 1Added Nimbus 0.6 L ha⁻¹; 2PNR – product not registered for the soybean crop, RET III.

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Rod. Carlos João Strass, s/n, access Orlando
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