Original Article

CHEMICAL CONTROL OF FOLIAR DISEASES IN SOYBEAN DEPENDS ON CULTIVAR AND SOWING DATE

O CONTROLE QUÍMICO DE DOENÇAS FOLIARES NA CULTURA DA SOJA DEPENDE DO CULTIVAR E DA ÉPOCA DE PLANTIO

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ABSTRACT: The aim was to study the effect of early application of two fungicide mixtures on the control of Asian rust and powdery mildew, as well as on grain yield in five soybean cultivars at two sowing dates. The experiment was carried in the experimental area of FAMV/UPF. The cultivars A 4910 RG (super-early), BMX Apolo RR, A 6001 RR and Fundacep 55 RR (early) and Coodetec 214 RR (moderate), established at 13/11/2007 and 3/12/2007 were used. Trifolia of these cultivars were treated twice with the fungicides ciproconazol + azoxystrobin (Priori Xtra®, 0.3 L ha-1 plus Nimbus® adjuvant 0.6 L ha^{-1}) and epoxiconazol + pyraclostrobin (Opera®, 0.5 L ha^{-1}), in three moments 1: pre-closure of the space between the lines and 21 days after; 2: pre-closure of space between rows and R5.1 stage (10% of beginning seed); and 3: R1 (beginning bloom) and R5.1 stages. The severity (% of affected leaf area) of powdery mildew and number of lesions cm^2 of Asian rust were evaluated. After that plants were harvested, the thousand grain weight (g) and grain yield (kg ha^{-1}) were quantified. The experimental design was a split-plot with four replicates, where the main plot were the five cultivars, and the subplots were the control treatment (untreated plants) and the six chemical control programs. Tukey and t-Student tests ($p \leq 0.05$) were used for separation of means of treatments and seasons, respectively. In general terms, foliar application of fungicides controlled both Asian rust and powdery mildew, as well as generated an increase on the thousand grain weight and grain yield. However, there seems to be an interaction among soybean genotypes and sowing date. Thus, our results allow us to infer that the chemical control of leaf diseases in the soybean crop depends of the cultivar and sowing date.

KEYWORDS: *Glycine max* L. Triazols. Strobilurins. Powdery mildew. Asian soybean rust. Grain yield.

INTRODUCTION

Diseases are the major problem in soybean crop, causing great damage and losses annually. In Southern Brazil, Asian rust (*Phakopsora pachyrhizi* Syd. & P. Syd.) and powdery mildew (*Erysiphe diffusa* (Cooke & Peck) U. Braun & S. Takam.) stand out. Asian rust intensity is directly influenced by the frequency of rainfall over the crop cycle (DEL PONTE et al., 2006). However, powdery mildew has been more intense in this region of the country in recent seasons due to low rainfall (DE ALMEIDA et al., 2014). In susceptible cultivars, both Asian Rust and powdery mildew may originate yield losses between 35 and 90%, respectively (HARTMAN et al., 1999).

The current soybean cultivars are susceptible to these foliar diseases, but there are variations in intensity among genotypes, due to possibly the climatic conditions of each season. These predisposing conditions in the no-tillage crop environment are related to the sowing time, due to the temperature and wetting conditions of each period (DE ALMEIDA et al., 2014).

The use of synthetic fungicides is the main tool used currently for the control foliar diseases, thus preserving the productive potential of soybean crop. However, some factors such as genotype choice, timing of application and season may affect the fungicides efficiency. For example, applications still in vegetative stages of crop and repeated up to three times, besides controlling the Asian rust, can generate an increase of plants leaf area, unlike of later applications (BOLLER et al., 2008; GARCÉS-FIALLOS; FORCELINI, 2011a; 2011b). For the control of powdery mildew in early cultivars with lower leaf area index, applications may be done before (BOLLER et al., 2008). On the other hand, the use of early-cycle cultivars and sowing at preferential times, but not late, may prevent a longer exposure time of trifolia to pathogen (REIS et al., 2006). However, the management of diseases such as Asian rust, as well as the choice of application time, is important in the maintenance of soybean leaves,

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which finally reflect in a higher grain weight (GARCÉS-FIALLOS; FORCELINI; 2011b).

Recommendations about fungicides spraying still in vegetative stage of soybean (pre-closure of space between the sowing lines), may reach the middle and lower third of plants, resulting in an adequate management of main diseases and increases in yield, stimulated the conduct of this experiment. Thus, the aim was to study the effect of early application of two fungicide mixtures on the control of Asian rust and powdery mildew, as well as on grain yield in five soybean cultivars at two sowing dates.

MATERIAL AND METHODS

The experiment was carried in the experimental area of Faculty of Agronomy and Veterinary Medicine, University of Passo Fundo, at 2007/08 crop season. Seed soybeans were sown in two seasons, the first at 13/11/2007 and the second at 03/12/2007.

Genotypes and treatments

Five cultivars of different cycles (DE ALMEIDA et al., 2014) were used, being three super-early (A 4910 RG), early (BMX Apolo RR, A 6001 RR and Fundacep 55 RR) and moderate (Coodetec 214 RR). The genotypes were chosen because they represent a large area of cultivation in State of Rio Grande do Sul.

Trifolia of the five cultivars were treated twice with the fungicides ciproconazol + azoxystrobin (Priori Xtra®, 0.3 L ha^{-1} plus Nimbus® adjuvant 0.6 L ha^{-1}) and epoxiconazol + pyraclostrobin (Opera®, 0.5 L ha^{-1}), in three moments 1: pre-closure of the space between the lines and 21 days after; 2: pre-closure of space between rows and R5.1 stage (10% of beginning seed); and 3: R1 (beginning bloom) and R5.1 stages. The volume of broth used in all applications was 200 L ha^{-1}, with spray tip TJ60 11002 (100), using a CO^2 pressurized spray, calibrated at a pressure of 2 bar.

Experimental conditions

The area used in this experiment contained white oats as previous crop (crop established during the winter harvest). With a no-tillage seeder were sown 12 seeds per linear meter. These seeds were first treated with the insecticide imidacloprid + thiodicarb (Cropstar®, 0.3 L ha^{-1}) and the fungicide carbendazin + thiram (Derosal Plus®, 0.2 L ha^{-1}). The experimental units were had six rows of five m spaced by 0.45 m, totaling 11.25 m^2 and 360 plants per experimental unit. The four rows central were considered the useful plot.

Fertilization in the sowing line was arranged of 250 kg ha^{-1} of formula N-P_2O_5-K_2O (0-20-30). Three applications of insecticides were carried during crop growth cycle. Other activities related to experiment management were carried out according to culture needs.

Evaluation of powdery mildew and Asian rust

The severity (% of affected leaf area) of powdery mildew and number of lesions cm^2 of Asian rust were quantified in all central leaflets of five soybean plants harvested at random on the two outer lines of the experimental unit. A stereoscopic microscope (ZEISS model Stemi 2000-C) was used for the quantification of these diseases. The severity assessment powdery mildew was estimated at 01/13 and repeated at 01/23, 02/2, 12/02, 22/02, 03/03, 03/13 and 03/23. The integration of the cumulative scores resulted in the area under the disease progress curve (AUDPC), according to trapezoidal integration equation described in Campbell; Madden (1990). The number of lesions cm^2 only was quantified at phenological stage R7.1 (beginning maturity and green leaflets).

Quantification of thousand grain weight and grain yield

Grain was harvested using a Wintersteiger combine harvester (Win-tersteiger AG, Ried/I, Austria), on the four central lines at phenological stage R9 (harvest maturity). Immediately after the harvest, the grains were separated from the impurity, standardized to 13% humidity and estimated the thousand grain weight (g) and grain yield (kg ha^{-1}). Plots of Fundacep 55 RR and CD 214RR plants established in the second season were affected by hail rain at 21/04/2008.

Experimental design and statistical analysis

The experimental design was a split-plot with four replicates, where the main plot were the five cultivars, and the subplots were the control treatment (untreated plants) and the six chemical control programs. After verification of homogeneity of the variances (Bartlett's test) and normality of the residues (Shapiro-Wilks test), data were subjected to analysis of variance. When the assumptions were satisfied, the data were submitted to ANOVA. Tukey and t-Student tests ($p \leq 0.05$) were used for separation of means of treatments and sowing date, respectively. All the analysis was performed in the GraphPad® Prism 5 statistical software.

RESULTS AND DISCUSSION

Evaluation of powdery mildew and Asian rust

Although Asian rust and powdery mildew were found and evaluated, the second disease affected the soybean cultivars more intensively over time. Perhaps the climatic conditions favored only powdery mildew. The average temperature and total rainfall among 01/01 and 04/04/2008 were 20.2 °C and 660.3 mm, respectively. Precipitation was below normal in January (Figure 1). *Erysiphe diffusa* the causal agent of powdery mildew, is favored by temperatures between 18 and 24 °C, and does not need leaf wetting, requiring only of between 50 and 90% relative air humidity (HARTMAN et al., 1999; GONÇALVES et al., 2009), conditions that were recorded in the experiment.

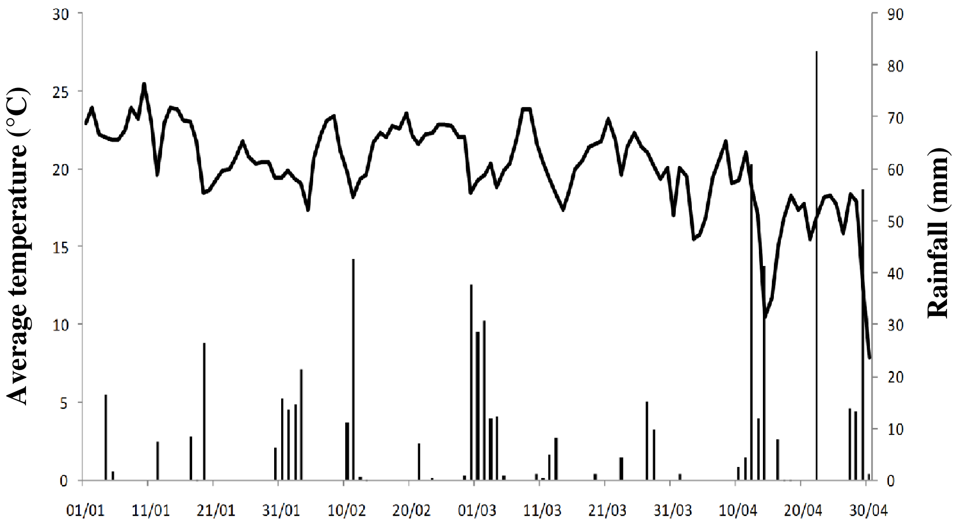

Figure 1. Rainfall (columns, mm) and average daily temperature (line, °C) from 01/01/2008 to 04/30/2008 in Passo Fundo, RS. Source: www.cnpt.embrapa/agromet/

The mixtures of fungicides applied at the three times reduced the AACPD of powdery mildew in average 50%, in most cultivars in the two sowing date, when compared to control (Table 1). The exception was in cv. Fundacep 55 RR in the second season, where the average spraying of pyraclostrobin + epoxiconazol at pre-closure of space between rows and phenological stage R5.1 was similar to control. It is known that mixtures as strobirulins and triazols efficiently controls the powdery mildew (GODOY; CANTERI, 2004). On the other hand, the advantage of use of fungicides mixtures is that the possibility of selection of fungicide resistant strains of powdery mildew may be reduced, besides contributing to the control of other soybean diseases as Asian rust (BLUM et al., 2002).

The AACPD of powdery mildew was different among the treatments with fungicide in some cultivars (Table 1). For instance, a higher control of powdery mildew was observed in leaflets of cv. BMX Apolo RR sprayed with azoxystrobin + ciproconazol in the second season. Although the two mixtures have similar chemical groups, there is the possibility that one of them has higher efficiency. In this regard, Garcés-Fiallos et al. (2011) comparing the efficiency of two fungicide mixtures to control leaf diseases in wheat crop, they found that pyraclostrobin + epoxiconazol together with spray nozzles that generate fine drops, besides controlling the diseases may generate an increase in grain yield. Another possibility is that the leaf area of some genotypes interfered in the fungicides spraying.

Table 1. Area under the disease progress curve (AUDPC) of powdery mildew based on the severity (%) on leaflets of six genotypes established in two sowing date, treated twice with the fungicides ciproconazol + azoxystrobin and epoxiconazol + pyraclostrobin, in three moments 1: pre-closure of the space between the lines and 21 days after; 2: pre-closure of space between rows and R5.1 stage (10% of beginning seed); and 3: R1 (beginning bloom) and R5.1 stages. Passo Fundo, RS, Brasil. Harvest 2007-2008

Fungicide	Stage	GENOTYPES									
		A 4910 RG		BMX Apolo RR		A 6001 RR		Fundacep 55 RR		Coodetec 214 RR	
		I	II	I	II	I	II	I	II	I	II
Untreated plants		65.11a	96.57a	68.23a	125.39a	69.67a	115.01a	37.98a	71.17a	40.63a	121.81a
Azoxystrobin + Ciproconazol	PRE + 21 days	10.55b[1]	27.48c	14.75b	58.00c	28.76b	48.35b	5.23b	26.59c	13.19b	71,56c
	PRE + R5.1	15.57b	22.16c	21.31b	55.14c	37.05b	51.31b	11.33b	22.39c	22.68b	75,45c
	R1 + R5.1	22.59b	53.17b	20.85b	52.48c	24.01b	54.82b	8.00b	31.41 bc	15.14b	66,67c
Pyraclostrobin + Epoxiconazol	PRE + 21 days	24.70b	54.35b	26.87b	99.70b	32.78b	69.42b	10.68b	25.93c	10.97b	68,92c
	PRE + R5.1	31.39b	55.68b	23.90b	90.69b	33.06b	73.06b	14.49b	58.67ab	25.89b	100,25b
	R1 + R5.1	23.77b	61.94b	19.74b	86.57b	22.86b	74.09b	13.03b	32.06bc	22.41b	76,54c
Means		26.98B	53.63A	27.50B	80.79A	35.20B	68.59A	13.86B	37.91A	21.81B	82.77A
CV (%)		36.09	21.91	37.97	10.04	21.00	13.5	43.11	26.69	24.72	7.65

[1] Means followed by lowercase and capital letters in the column and row, respectively, do not differ significantly by the Tukey test ($p \leq 0.05$).

Fungicides generated a control of Asian rust in average 80%, when compared to control (Table 2). The efficiency of these mixtures to control this disease has been reported by several authors (GODOY; CANTERI, 2004; SCHERM et al., 2009). For instance, pyraclostrobin + epoxiconazol applied at phenological stage V9 (stem with nine leaf) besides controlling the disease (GARCÉS-FIALLOS; FORCELINI, 2011a; GARCÉS-FIALLOS; FORCELINI, 2013), may generate an increase in leaf area of soybean plants (GARCÉS-FIALLOS; FORCELINI, 2011b). However, the number of lesions cm^{-2} in control leaflets of some cultivars was similar to treated ones (BMX Apolo RR and Coodetec 214 RR in the two and the first season, respectively) or some application time (phenological stages R1 and R5.1) with pyraclostrobin + epoxiconazol (A 6001 RR). Perhaps, the low intensity of the disease in these cultivars and sowing date interfered in the results, generating even a high coefficient of variation.

A higher intensity of Asian rust and powdery mildew was observed in the cultivars evaluated in the second sowing season, when compared to first (Tables 1 and 2), possibly due to inoculum source of plants established in the first season. Considering the availability of inoculum, the first crops may present lower disease intensity compared to the later ones. The inoculum availability is higher in areas sown at end of the recommended period (REIS et al., 2006).

Leaf spraying made in the second season at pre-closure of space between rows + phenological stage R5.1 (cvs. Fundacep 55 RR and Coodetec in the two season) and at phenological stages R1 + R5.1 (cv. A 6001 RR) did not efficiently control powdery mildew and Asian rust, respectively. Perhaps, to powdery mildew the time interval was too long, whereas to Asian rust the fungicides application was late.

Between the intensity of diseases and the cycle of cultivars, only was observed an increasing behavior of Asian rust. For instance, the number of lesions cm^{-2} in leaflets of cv. 4910 RG super-early was in average 20-fould higher than that of cv. CD 214 RR moderate-cycle (Table 2). The use of early-cycle plants may reduce the time of exposure to pathogen, as well as sowing at preferential seasons, avoiding late sowings. Early-cycle cultivars may have lower damage when compared to late-cycle ones (REIS et al., 2006). According to Forcelini (2009), two applications would be enough to protect the early and semi-early cultivars. However, our results showed that two applications were sufficient to control the disease. What must be taken into account is that in longer-cycle genotypes, there is a final period of one to two weeks in which plants may be damaged by increased disease intensity (FORCELINI, 2009).

Quantification of thousand grain weight and grain yield

The thousand grain weight was in average 10% higher in plants treated with fungicide, compared to those not treated (Table 3). Fungicides applications in soybean crops generate a higher number of grains, pods, grains per pods and grain weight per plant (SOARES et al., 2004; GARCÉS-FIALLOS; FORCELINI, 2011b). However, the mixtures and the application times differentially affected this productive variable in the evaluated genotypes.

Although the fungicides applied in pre-closure of the space between the lines may induce an increase of grain yield, besides controlling diseases such as Asian rust (GARCÉS-FIALLOS; FORCELINI, 2013), this behavior seems to depend of genotype and season. For instance, the cvs. A 4910 RG and Fundacep 55 RR in the first and second sowing date, respectively, the thousand grain weight of one of the treatments was similar to control.

Fungicides positively affected grain yield of cv. BMX Apolo RR and A 6001 RR in both sowing date, and of cvs. Coodetec 214 RR and A 4910 RG in the first and second sowing date, respectively, when compared to control (Table 4). Fungicides application in aerial part of soybean crop, besides reducing the Asian rust, may influence in a higher yield of grains (MILES; LEVY, 2007). The higher production obtained in these cultivars was possibly due to protection of healthy leaf area. This variable may influence the grain filling (GARCÉS-FIALLOS; FORCELINI, 2011b), reflecting itself at the end on grain yield. However, this productive variable was influenced by the moment of application, differently in each genotype and season. For example, in the first season the grain yield in cv. A 6001 RR treated with azoxystrobin + ciproconazol was lower than those treated with pyraclostrobin + epoxiconazol. Meanwhile, in the second season there was no difference between fungicides and grain yield.

No difference was found among treatments in cvs. Fundacep 55 RR and Coodetec 214 RR, in the second sowing season. Perhaps, the occurrence of hail rain occurred at 04/21/2008 affected this variable.

Table 2. Number of lesions cm^2 of Asian rust on leaflets of six genotypes established in two sowing date, treated twice with the fungicides ciproconazol + azoxystrobin and epoxiconazol + pyraclostrobin, in three moments 1: pre-closure of the space between the lines and 21 days after; 2: pre-closure of space between rows and R5.1 stage (10% of beginning seed); and 3: R1 (beginning bloom) and R5.1 stages. Passo Fundo, RS, Brasil. Harvest 2007-2008

Fungicide	Stage	GENOTYPES									
		A 4910 RG		BMX Apolo RR		A 6001 RR		Fundacep 55 RR		Coodetec 214 RR	
		I	II	I	II	I	II	I	II	I	II
Untreated plants		1.23a	2.19a	0.02a	1.71a	2.84a	19.21a	13.61a	72.98a	2.19a	58.43a
Azoxystrobin + Ciproconazol	PRE + 21 days	0.06b	0.00b	0.03a	0.15a	0.66b	2.76c	0.07b	2.97b	0.42a	8,33b
	PRE + R5.1	0.06b	0.00b	0.04a	0.02a	0.05b	2.48c	0.02b	0.68b	0.51a	5,25b
	R1 + R5.1	0.00b	0.00b	0.02a	0.03a	0.02b	3.37c	0.06b	0.67b	0.03a	3,71b
Pyraclostrobin + Epoxiconazol	PRE + 21 days	0.06b	0.19b	0.03a	0.36a	0.28b	8.89b	1.10b	5.34b	0.26a	6,35b
	PRE + R5.1	0.18b	0.02b	0.03a	0.62a	0.29b	8.32b	0.10b	8.84b	1.39a	10,45b
	R1 + R5.1	0.18b	0.29b	0.03a	0.03a	0.08b	17.53a	0.38b	3.85b	0.05a	5,91b
Means		0.24	0.37	0.03B	0.40A	0.57B	8.77A	2.02B	14.12A	0.71B	13.67A
CV (%)		20.02	64.22	18.02	53.24	35.44	35.70	49.86	49.07	49.55	18.46

[1] Means followed by lowercase and capital letters in the column and row, respectively, do not differ significantly by the Tukey test ($p \leq 0.05$).

Table 3. Thousand grain weight (g) on plants of six genotypes established in two sowing date, treated twice with the fungicides ciproconazol + azoxystrobin and epoxiconazol + pyraclostrobin, in three moments 1: pre-closure of the space between the lines and 21 days after; 2: pre-closure of space between rows and R5.1 stage (10% of beginning seed); and 3: R1 (beginning bloom) and R5.1 stages. Passo Fundo, RS, Brasil. Harvest 2007-2008

Fungicide	Stage	GENOTYPES									
		A 4910 RG		BMX Apolo RR		A 6001 RR		Fundacep 55 RR		Coodetec 214 RR	
		I	II	I	II	I	II	I	II	I	II
Untreated plants		168.30c[1]	146.66c	157.68c	128.25c	134.35c	112.79c	155.18c	146.89bc	119.81b	99.20b
Azoxystrobin + Ciproconazol	PRE + 21 days	188.05b	164.63a	166.29b	146.82a	143.71b	132.36a	168.64b	151.16ab	129.45a	115,82a
	PRE + R5.1	185.24b	165.41a	171.39a	146.19a	141.35b	128.61a	174.15a	161.39a	133.85a	116,19a
	R1 + R5.1	196.63a	160.01a	179.78a	145.34a	146.03b	131.30a	174.03a	151.24ab	137.43a	114,84a
Pyraclostrobin + Epoxiconazol	PRE + 21 days	172.97c	160.73a	168.09b	136.72b	146.69b	120.41b	168.99b	148.89b	138.64a	109,98a
	PRE + R5.1	189.78b	161.71a	168.24b	134.36b	161.87a	128.80a	161.69b	140.08c	132.05a	109,38a
	R1 + R5.1	186.60b	157.79b	175.36a	144.20a	156.82a	124.10b	176.90a	146.31bc	127.76a	113,87a
Means		183.94A	159.56B	169.55A	140.27B	147.26A	125.48B	168.51A	149.42B	131.28A	111.87B
CV (%)		5.14	6.31	3.32	6.85	6.29	5.94	3.84	4.18	7.45	5.62

[1] Means followed by lowercase and capital letters in the column and row, respectively, do not differ significantly by the Tukey test (p≤0.05).

Table 4. Grain yield (kg ha^{-1}) on plants of six genotypes established in two sowing date, treated twice with the fungicides ciproconazol + azoxystrobin and epoxiconazol + pyraclostrobin, in three moments 1: pre-closure of the space between the lines and 21 days after; 2: pre-closure of space between rows and R5.1 stage (10% of beginning seed); and 3: R1 (beginning bloom) and R5.1 stages. Passo Fundo, RS, Brasil. Harvest 2007-2008

Fungicide	Stage	GENOTYPES									
		A 4910 RG		BMX Apolo RR		A 6001 RR		Fundacep 55 RR		Coodetec 214 RR	
		I	II	I	II	I	II	I	II	I	II
Untreated plants		3122.43b[1]	2309.67b	2350.80b	2300.40b	2485.78c	1561.08b	3595.99b	864.81a	2186.79c	990.62a
Azoxystrobin + Ciproconazol	PRE + 21 days	3796.30a	3081.27a	3994.89a	3389.51a	3499.75b	2373.44a	4375.09a	821.17a	2575.16b	1251,42a
	PRE + R5.1	2998.97b	3266.46a	4022.42a	3402.56a	3206.28b	2191.79a	4351.98a	821.26a	2988.89a	1277,78a
	R1 + R5.1	3261.32b	3122.43a	4156.82a	3149.16a	3474.30b	2060.06a	4197.64a	995.53a	3018.31a	1123,73a
Pyraclostrobin + Epoxiconazol	PRE + 21 days	3240.74b	2937.24a	4052.01a	3044.34a	3859.14a	2128.31a	3816.18ab	883.39a	2834.07a	1200,92a
	PRE + R5.1	3708.85a	2906.38a	3952.58a	3380.09a	3807.93a	2183.81a	3598.04b	753.38a	2935.54a	1117,32a
	R1 + R5.1	3148.15b	2854.94a	3924.57a	3160.75a	3734.55a	2120.34a	4093.36a	891.67a	2951.45a	1306,23a
Means		3325.25A	2925.48B	3779.16A	3118.12B	3409.67A	2088.40B	4001.18A	861.60B	2784.31A	1181.14B
CV (%)		14.16	5.69	12.69	9.49	9.39	10.91	14.99	19.10	13.03	20.91

[1] Means followed by lowercase and capital letters in the column and row, respectively, do not differ significantly by the Tukey test (p≤0.05).

A higher thousand grains weight and grain yield was observed in all genotypes planted in the second sowing season, compared to first one. Perhaps, both a higher disease intensity and late sowing may have contributed to reduction of productive potential. The vegetative and productive performance of soybean cultivars are influenced by the sowing date (PEREIRA-PEIXOTO et al., 2000; GALLOTI et al., 2005; GARCÉS-FIALLOS et al., 2014). Even this factor is the one that most influence on grain yield (PEREIRA-PEIXOTO et al., 2000).

In this work was found an interaction among soybean genotypes and planting date in both sanitary and productivity variables. This should be taken into account to recommending the sowing season, as well as fungicides and application times, to control diseases such as Asian rust or powdery mildew.

CONCLUSION

Our results indicate that the chemical control of leaf diseases in soybean crop depends of the cultivar and sowing date.

RESUMO: O objetivo foi estudar o efeito da aplicação antecipada de duas misturas de fungicidas no controle da ferrugem asiática e do oídio, bem como no rendimento de grãos em cinco cultivares de soja em duas épocas de semeadura. O experimento foi conduzido no campo experimental da FAMV/UPF. Utilizaram-se as cultivares A 4910 RG (super precoce), BMX Apolo RR, A 6001 RR e Fundacep 55 RR (precoces) e Coodetec 214 RR (moderado), estabelecidas em 13/11/2007 e 3/12/2007. Os fungicidas piraclostrobina + epoxiconazole e azoxistrobina + ciproconzole foram pulverizados duas vezes em 1: pré-fechamento do espaço entre as linhas e 21 dias após, 2: pré-fechamento do espaço entre as linhas e R5.1 (10% de granação), e 3: R1 (início da floração) e R5.1. Avaliaram-se a severidade (% da área foliar afetada) do oídio e o número de lesões cm^2 da ferrugem asiática. Logo após as plantas foram colhidas, o peso de mil grãos (g) e rendimento de grãos (kg ha^{-1}) foram quantificados. O delineamento experimental utilizado foi o de parcelas divididas com quatro repetições, onde a parcela principal foram as cinco cultivares, e as subparcelas foram o tratamento controle (plantas não tratadas) e os seis programas de controle químico. Para a separação das médias dos tratamentos e épocas, foram utilizados os testes de Tukey e t-Student ($p \leq 0.05$), respectivamente. De modo geral, a aplicação foliar de fungicidas controlou tanto a ferrugem asiática como o oídio, assim como também gerou um aumento do peso de mil grãos e rendimento de grãos. No entanto, parece existir uma interação entre os genótipos e data de semeadura. Assim, nossos resultados nos permitem inferir que o controle químico das doenças foliares na cultura da soja depende do cultivar e da data de semeadura.

PALAVRAS-CHAVE: *Glycine max* L. Triazóis. Estrobilurinas. Oídio. Ferrugem asiática. Rendimento de grãos.

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