

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: - www.journalijar.com</p> <h2>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</h2> <p>Article DOI: 10.21474/IJAR01/4993 DOI URL: http://dx.doi.org/10.21474/IJAR01/4993</p>	
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RESEARCH ARTICLE

EFFECT OF CHEMICAL CONTROL WITH FUNGICIDES ON RICE-STAINED GRAIN INCIDENCE.

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Manuscript Info

Manuscript History

Received: 28 May 2017
Final Accepted: 30 June 2017
Published: July 2017

Key words:-

Oryza sativa, stained grains, rice-stained grain, foliar fungicides, application time.

Abstract

An experiment was carried out in the locality of San Juan Bautista, Department of Misiones, Paraguay, rice crop season 2014/2015, to determine the effect of foliar application of fungicide on rice stained grain incidence. The treatments consisted on application of a mixture of fungicides Azoxystrobin 20% + Difenconazole 12,5% (400 cc/ha) mixed with 400 cc of oil Nimbus at different rice growth stages. The experimental design used was randomized complete blocks with four replicates. The results indicated that treatments with 3 applications at R2, R3, R4 and 5 applications at R1, R2, R3, R4 and R6 resulted in a lower average incidence of rice-stained grain, 7.0 % and 11% respectively. Applications in a single opportunity at stages R1, R2, R3 and R4 showed a range of incidence between 30.7% - 44.5%, being the lower average incidence in R4. These results indicate that fungicide applications from R4 have a tendency to decrease the incidence of rice stained grains. The control without chemical protection had the highest incidence (69.34%).

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Introduction:-

Rice crop is attacked by several foliar fungus diseases especially those seed-borne transmitted fungus such as *Pyricularia oryzae*, *Bipolaris oryzae*, *Alternaria padwickii*, *Curvularia sp.* and others, most of them reported as causing the so-called rice stained grain disease (Ou 1984, Mew and Gonzales 2002). Quintana et al. (2017) reported 6 fungal species associated with the rice stained grain in Paraguay.

Rice-stained grain is a potentially highly destructive disease, leading to major crop losses worldwide and decreasing seed quality. It is characterized by spots on the glumes, however it can also affect the endosperm and sometimes the embryo when discoloration is very deep. The stained grain produces a high percentage of empty seeds, decrease germination, reduction of the number of grains by panicles and stained grains weight, and diminishes the quality of the grain. It is usually associated with the presence of a complex of fungi in the panicles (Gutiérrez and Mazzanti 2001, Mew & Gonzales, 2002).

Leaf diseases and rice-stained rice compromise yields up to 42% related to plots non chemical protection (Dallagnol et al., 2006).

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In Paraguay it has been carried out research on rice seed health, and incidence of fungi associated with stained grains. However, the information related to chemical control of the disease is not available. The objective of this work was to determine the effect of foliar fungicides application at different rice growth stages on rice-stained grains incidence.

Materials And Methods:-

The research work was carried out in the district of San Juan Bautista, Department of Misiones, Paraguay, in the season 2014/2015. The experimental design used was randomized complete blocks with four replicates. The size of the experimental unit was 2.04 x 5 m; each experimental unit 12 rows of 0.17 m between them. The variety used was IRGA 424. Treatments consisted of fungicide mixture application at different rice growth stages: Azoxystrobin 20% + Difenconazole 12,5% (400cc/ha), mixed with 400 cc of the oil (Nimbus) . Table 1 shows the treatments performed and the growth stages in which they were applied. The applications were made with backpack sprayer of constant pressure by source of CO₂, with four peaks teejet 8001, 2 kPa pressure.

Table 1:-Application of thefungicide mixture at differentgrowthstages in thevariety IRGA 424.

Fungicides/growth stage	Growth stages	Description
Control	0	-
Azoxystrobin 20 % +Difenoconazol 12,5%	R1	Panicle branches have formed
Azoxystrobin 20 %+Difenoconazol 12,5%	R2	Collar formation on flag leaf-booting
Azoxystrobin 20 % + Difenoconazol 12,5%	R3	Panicle exsertion from boot, tip of panicle is above collar of flag leaf
Azoxystrobin 20% +Difenoconazol 12,5%	R4	One or more florets on the main stem panicle has reached anthesis
Azoxystrobin 20 % + Difenoconazol 12,5%	R4 R6	One or more florets on the main stem panicle has reached anthesis At least one caryopsis on the main stem panicle has elongated to the end of the hull Milky gain
Azoxystrobin 20 % +Difenoconazol 12,5%	R2 R3	Collar formation on flag leaf Panicle exsertion from boot, tip of panicle is above collar of flag leaf
Azoxystrobin 20 % + Difenoconazol 12,5%	R3 R4	Panicle exsertion from boot, tip of panicle is above collar of flag leaf One or more florets on the main stem panicle has reached anthesis
Azoxystrobin 20 % +Difenoconazol 12,5%	R2 R3 R4	Collar formation on flag leafinicio de emisión floral Panicle exsertion from boot, tip of panicle is above collar of flag leaf One or more florets on the main stem panicle has reached anthesis
Azoxystrobin 20 % + Difenoconazol 12,5%	R1 R2 R3 R4 R6	Panicle branches have formed Collar formation on flag leaf-booting Panicle exsertion from boot, tip of panicle is above collar of flag leaf One or more florets on the main stem panicle has reached anthesis At least one caryopsis on the main stem panicle has elongated to the end of the hull

Source:-Moldenhauer, K.,et al. 2015. Rice Growth and Development, Chapter 1. Arkansas Rice Production Handbook.

SampleCollection:-

To evaluate the incidence of spotted grains, samples were extracted 22 days after the last application of the fungicide (stage R9). Samples were taken from the central row, 1 linear m/ of each experimental unit, placed in burlap bags with their corresponding identification. In the laboratory, 10 panicles from each experimental unit were randomly selected, and manually peeled to evaluate stained grains. The obtained data were processed through the analysis of variance. Tukey test ($P \leq 0.05$) was used to compare means.

Results and Discussion:-

The analysis of variance for spotted grains incidence resulted in a highly significant difference, with a mean of 30.2%. Control without chemical protection had the highest incidence (69.34%). Treatments with 3 applications (R2, R3, R4) and 5 applications (R1, R2, R3, R4, R6) had the lowest spotted grains incidence (7% and 11%). These treatments were statistically similar to those with 2 applications treatments (R3, R4) and (R4, R6). When the fungicide was applied in a single opportunity, R1, R2, R3 and R4, incidence ranged from 30.7% to 44.5%, the lowest incidence rate was in R4 (30.7%). These results indicate that fungicide applications from R4 have a tendency to decrease the incidence of rice staining grains.

Table 2:-Spotted grain incidence and comparison of means treated with fungicides applied at different rice growth stages

Fungicide application/growth stage	Stained grains(%)	Tukey 5%
Control	69,3	D
R1	44,5	C
R2	36,2	C
R3	41,6	C
R4	30,7	BC
R4, R6	17,2	AB
R2, R3	38,7	C
R3, R4	17,1	AB
R2, R3,R4	7,2	A
R1, R2, R3, R4,R6	11,1	A
Mean	30,2	
CF	36,14**	
VC	19,93	

CF = calculated F ; CV =coefficient variation, **: highly significant; Different letters indicate significant differences

Bordin et al. (2013) reported that with 3, 4 and 5 applications of fungicides, obtained a reduction of 27%, 37.8% and 47% on the stained grains incidence. Pérez Vicente et al. (2009) observed good control of complex diseases that cause stained grains when using fungicides containing azoxystrobin as active ingredient. Gutierrez et al. (2006) detected differences between the percentage of clean grains and grain weight between the fungicide azoxystrobin and the control without chemical protection

Early application of fungicides did not show any significant differences between them, thus demonstrating that applications at these stages had little effect to reduce the incidence of stained grains

As conclusion, we emphasize that, it was observed a decrease in the number of stained grains in those treatments that had application of fungicides. Applications from R4, show a favorable effect in relation to the disease.

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