MONITORING POTENTIAL *LAMBDA-CYHALOTHRIN* RESISTANT RICE STINK BUG, *OEBALUS PUGNAX* POPULATIONS IN ARKANSAS RICE PRODUCTION

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Abstract

Rice stink bug (RSB) (*Oebalus pugnax*) is a major pest of rice, feeding on the developing grain. Few insecticides are available to rice producers for RSB management. Lambda-cyhalothrin (Lambda) is the most common insecticide used to manage RSB, providing adequate control at low cost. Over 50% of Arkansas rice acreage is treated with Lambda for control of RSB annually. Other options, such as Tenchu (Dinotefuran), are effective for control but not at a competitive price point. The dependency on Lambda for RSB control, and control issues observed in Louisiana and Texas, raises concern for RSB resistance in Arkansas. New options for RSB need to be evaluated in preparation for resistance to Lambda. Foliar efficacy field trials were conducted in 2021 to compare insecticides for efficacy and residual control of rice stink bug. Sweep net samples were taken at 3, 7, 10, and 13 DAT to monitor RSB efficacy. Additionally, assays were conducted on multiple RSB populations in 2021 throughout the growing season. After adults were collected, Lambda was applied to petri dishes at five different rates with an untreated for comparison with 10 replications. Dishes were allowed to dry then five RSB were placed in each dish. Mortality was assessed at 24 hours after infestation. The 24-hour mortality ratings averaged 82% mortality. In May, 80% mortality was achieved with the 1X, 2X, and 4X rates. In June and July 80% mortality was never reached, regardless of rate applied. Lower mortality in June and July could be due to healthier RSB populations (2nd & 3rd generations), compared to May with first generation RSB populations. Results from this research will increase awareness of insecticide resistance and educate growers in respective management tactics.

Introduction

Rice stink bug (RSB) is the major pest in heading rice in Arkansas and can cause significant damage to rice, resulting in yield and quality loss on a yearly basis. During the past three growing seasons ~ 50% of the rice acreage in Arkansas received an insecticide application for the control of rice stink bug. Limited insecticides are available to rice growers for controlling rice stink bug, and available products lack consistent residual control. Lambda-cyhalothrin (Lambda) is the most used insecticide when applications are required for RSB. Lambda is highly efficacious and cost effective for growers. Dinotefuran (Tenchu) is another reliable insecticide for the control of rice stink bug, but at a higher price compared to Lambda. Tenchu being more costly than Lambda, prevents adoption of this product. While Lambda continues to be the primary insecticide used for control of RSB, concerns regarding the development of insecticide resistance occurs. Concerns of resistance has driven research to begin testing alternative products for rice stink bug suppression, while developing and implementing other IPM practices.

Methods

Foliar Efficacy Trial

Foliar efficacy trials were conducted in Altheimer, AR in 2021 to compare labeled insecticides for efficacy and residual for RSB control. Applications of insecticides were made with a 12-foot hand boom (10GPA), plot size was12ft by 35ft. Treatments were arranged in a randomized complete block design with four replications (Table 1). Sweep net sampling was performed at 3, 7, 10, and 13 DAT to monitor RSB populations. Data was analyzed in PROC GLIMMIX with SAS v 9.4 at an alpha level of 0.05.

Insecticide Resistance Bioassay
Bioassays were performed throughout 2021. RSB's were collected over a total of 14 locations throughout Arkansas. In May 4 collections were made, while June and July both had 5 collections. RSB collections were made with sweep nets in rice fields, wheat fields, and native grasses. RSB's were stored in bug dorms and held overnight to ensure healthy RSB's were used for infestation. Plants were placed in bug dorms for feeding and cotton balls soaked in sugar water for moisture. Lambda was applied to petri dishes at five different rates: 0.46 oz/a (0.25X), 0.93 oz/a (0.5X), 1.86 oz/a (1.0X), 3.72 oz/a (2.0X), and 7.44 oz/a (4.0X) and an untreated check for comparison. Each treatment was replicated ten times. Petri dishes were allowed to dry before inserting five RSB's in each dish. Mortality was assessed at 24 hours after infestation.

Results

Foliar Efficacy Trial
At 3 and 7 DAT (Figure 1 and Figure 2) Malathion, Tenchu, and Endigo provided more control of both adults and nymphs compared to Lambda and Mustang Maxx, which were both approximately double threshold. At 10 DAT (Figure 2) Malathion, Carbaryl, Tenchu, and Endigo continued to hold nymph numbers below threshold. At 13 DAT (Figure 3) besides the pyrethroids, all other insecticides provided adequate control of nymphs. Total RSB populations increased due to migrating adults entering the plots.

Bioassay study
In May, no significant differences were observed between the 1X, 2X, and 4X rates (Figure 5), similar trends were observed in June (Figure 6), and July (Figure 7). Lower mortality compared to May was observed in June and July. Average over the 14 locations, 80% mortality was not achieved (Figure 8). No treatment in any month achieved 100% mortality, all treatments had increased mortality compared to the untreated check.

Table 1. Insecticide Names, Rates, and insecticide class included in analysis.

Insecticide Name	Rate (oz/a)	Insecticide Class
Lambda-cyhalothrin	32 (oz/a)	Pyrethroid
Mustang Maxx	4 (oz/a)	Pyrethroid
Tenchu	8 (oz/a)	Neonicotinoid
Carbaryl	32 (oz/a)	Carbamate
Malathion	32 (oz/a)	Organophosphate
Endigo	5-6 (oz/a)	Neonicotinoid+Pyrethroid

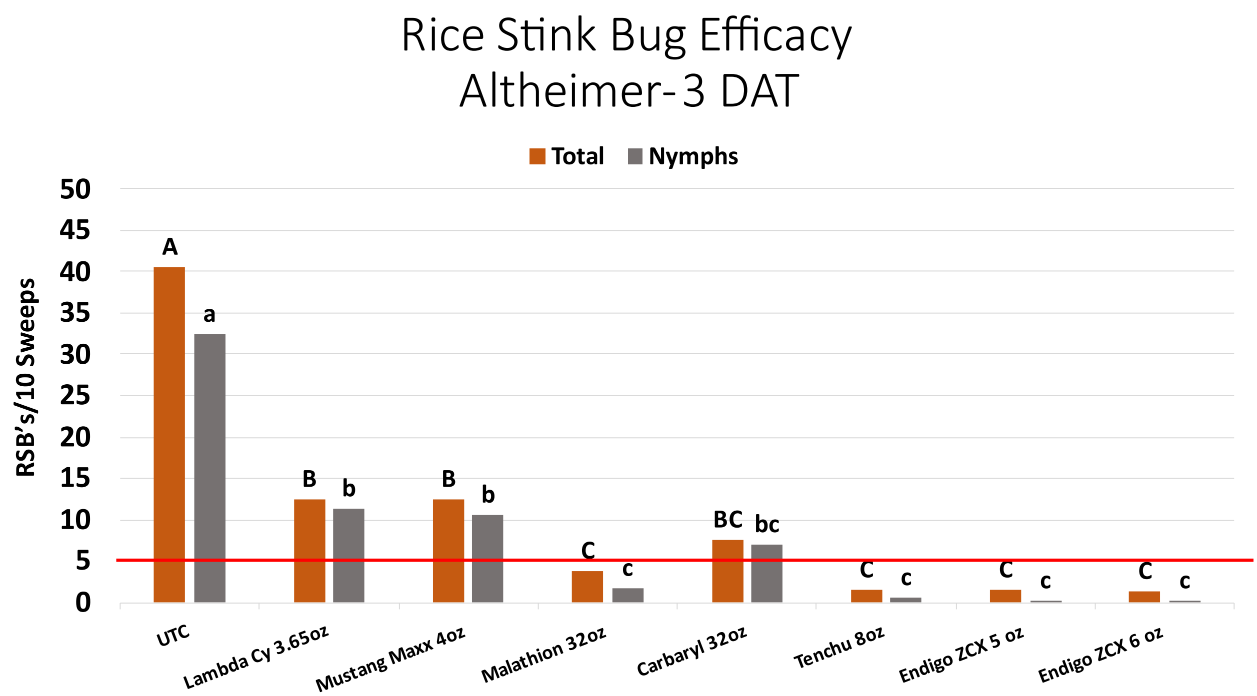

Figure 1. Efficacy trials at 3 DAT comparing labeled insecticides for control of RSB in Altheimer, AR. Red line is set at 5, representing the threshold.

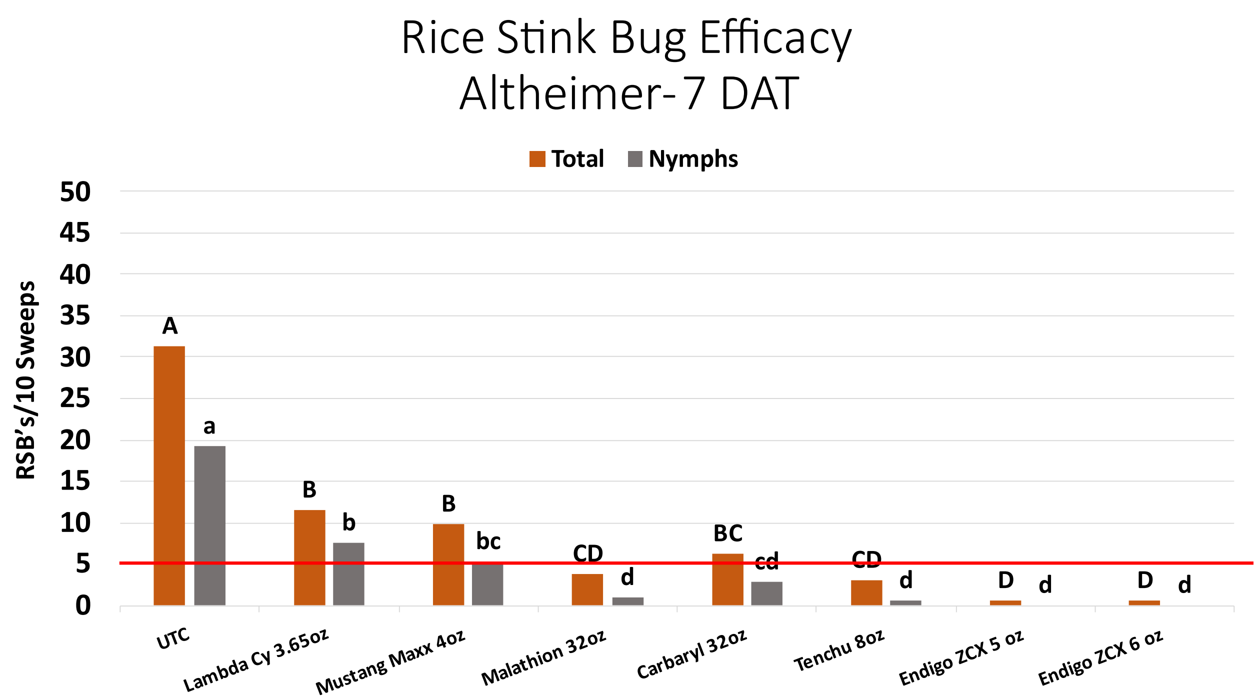

Figure 2. Efficacy trials at 7 DAT comparing labeled insecticides for control of RSB in Altheimer, AR. Red line is set at 5, representing the threshold.

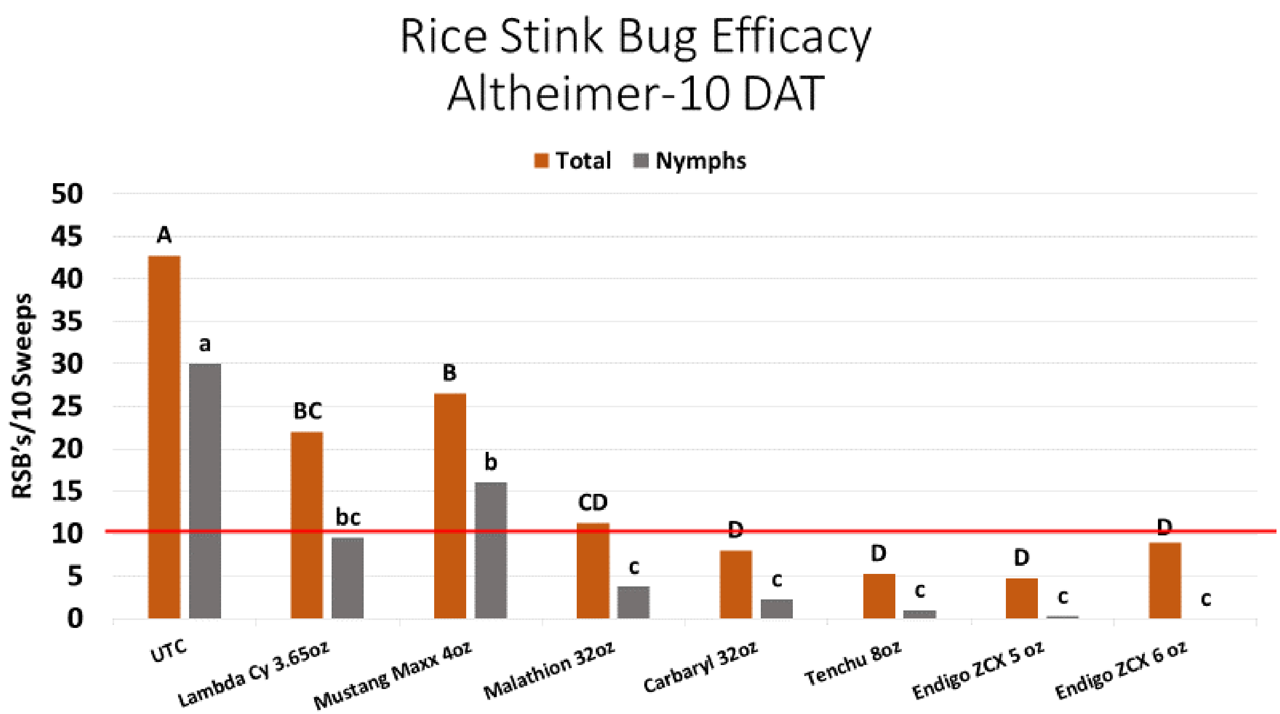

Figure 3. Efficacy trials at 10 DAT comparing labeled insecticides for control of RSB in Altheimer, AR. Red line is set at 10, representing the threshold.

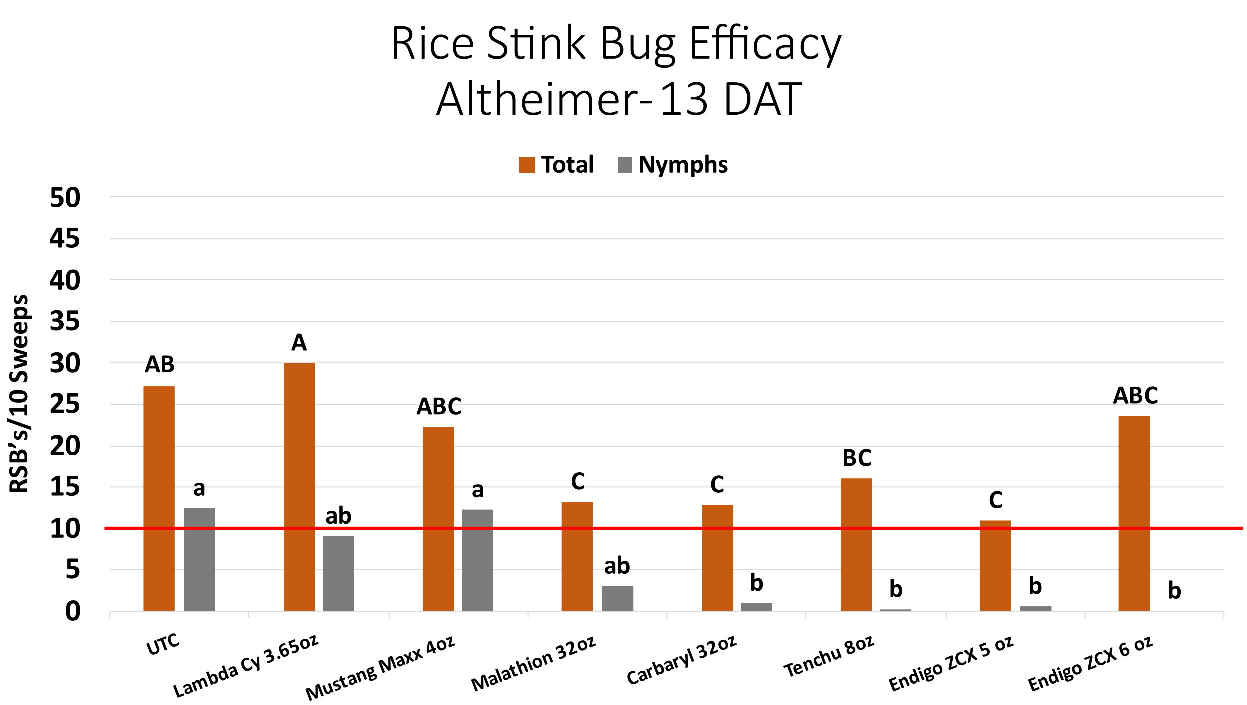

Figure 4. Efficacy trials at 13 DAT comparing labeled insecticides for control of RSB in Altheimer, AR. Red line is set at 10, representing the threshold.

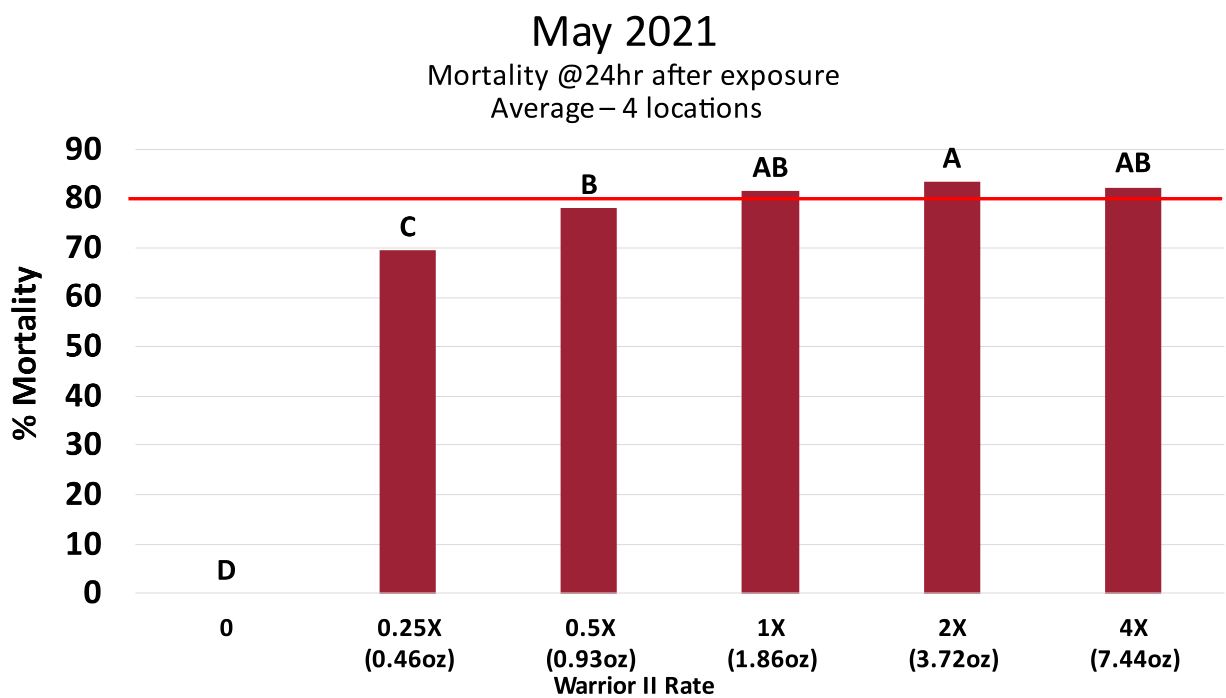

Figure 5. Efficacy of Lambda for RSB at multiple rates 24 hours after exposure in May. Red line shows percent mortality to be considered good control.

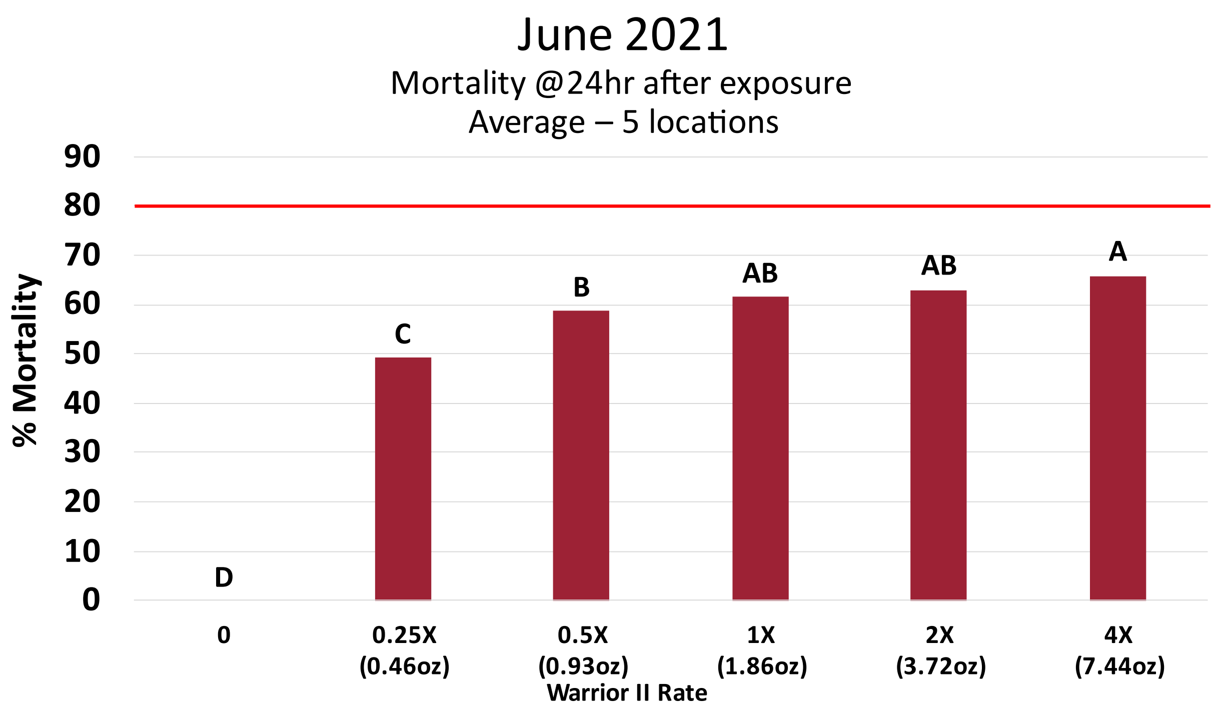

Figure 6. Efficacy of Lambda for RSB at multiple rates 24 hours after exposure in June. Red line shows percent mortality to be considered good control.

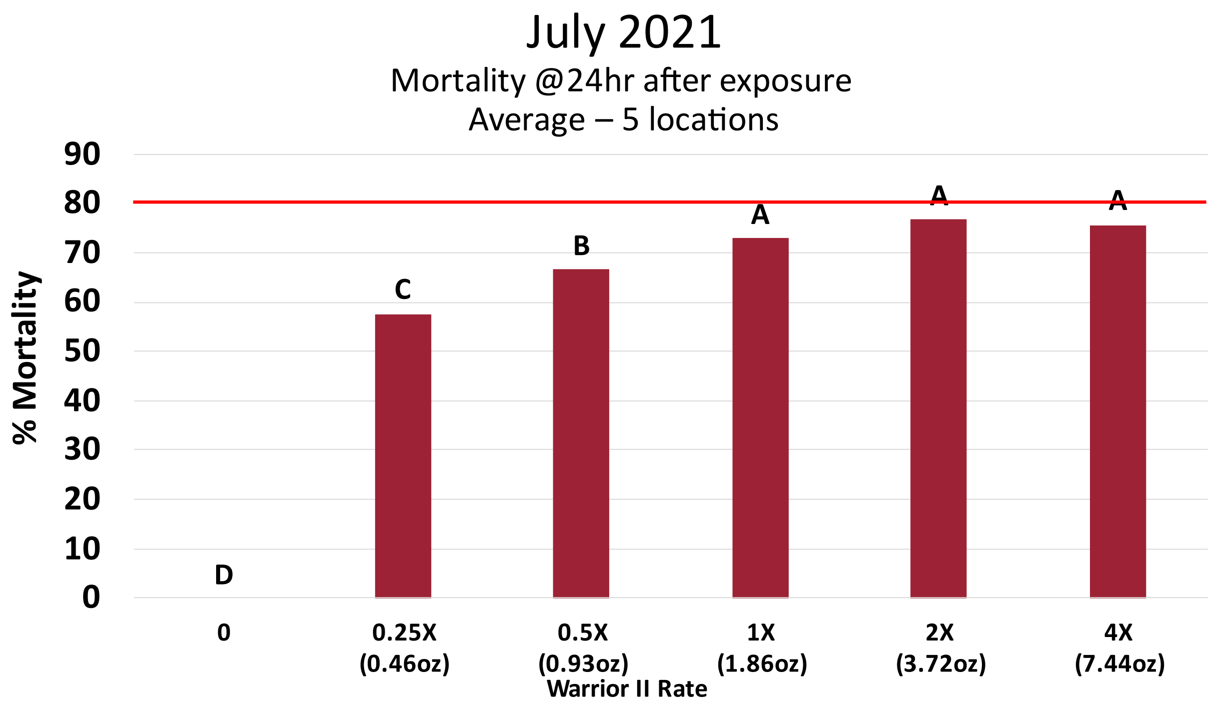

Figure 7. Efficacy of Lambda for RSB at multiple rates 24 hours after exposure in July. Red line shows percent mortality to be considered good control.

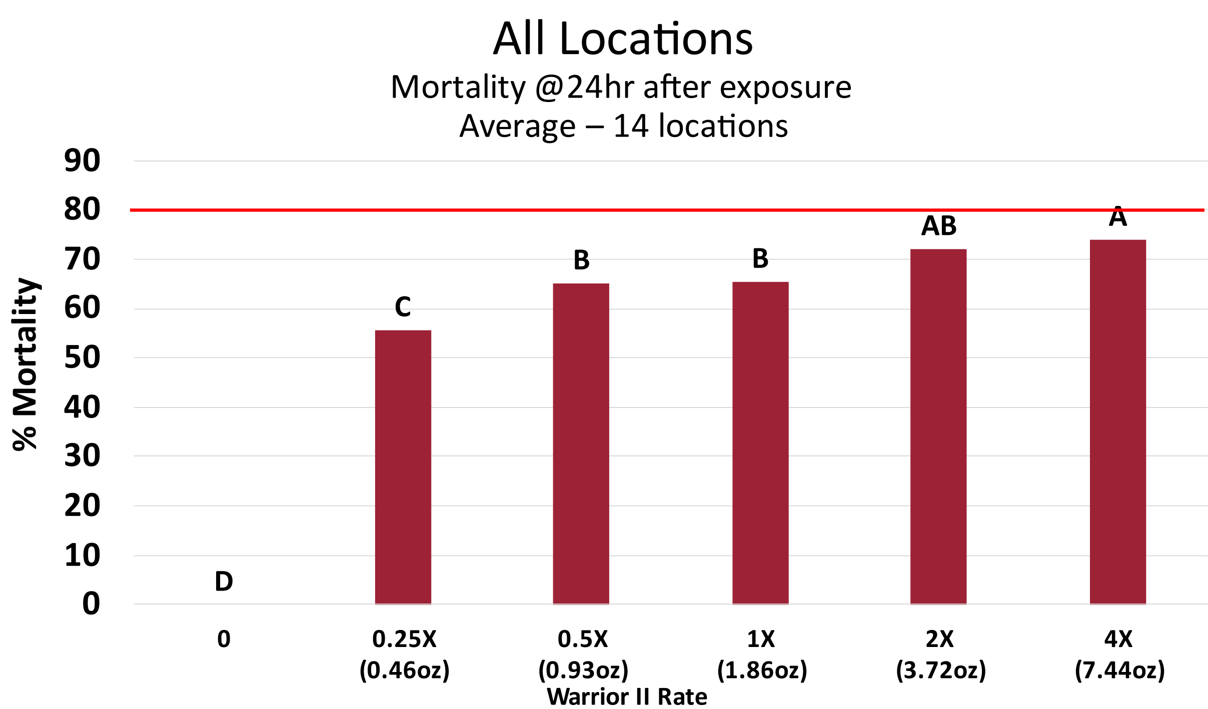

Figure 8. Efficacy of Lambda for RSB at multiple rates 24 hours after exposure on average of 14 locations. Red line shows percent mortality to be considered good control.

Summary

Applications of lambda-cyhalothrin should still be considered but growers should also be prepared to change if adequate control isn't achieved, if rice stink bug nymphs are found after Lambda application, rotating to Tenchu is recommended. Efficacy studies focused on nymph numbers rather than adult numbers, due to plot sizes being relatively small, and the rest of the field not receiving an insecticide treatment. Assay results indicate that resistance/tolerance of rice stink bugs to Lambda may be a developing issue for Arkansas rice producers. May populations are the first generation RSB's, which are weaker compared to June and July populations who have built up their fat bodies, May was the only month to achieve 80% mortality. Future research will be conducted to monitor resistant populations.

Acknowledgements

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