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

T. Newkirk
N.R. Bateman
G.M. Lorenz
B.C. Thrash
N.K. Joshi
S.G. Felts
N.M. Taillon
W.A. Plummer
C.A. Floyd
C. Rice
University of Arkansas Cooperative Extension Service
Stuttgart, Arkansas

Abstract

Rice stink bug (*Oebalus pugnax*) is a major pest of rice, feeding on developing grain, which can lead to yield and quality losses. Few insecticides are currently available to rice producers for rice stink bug management and those that are labeled, lack residual control. Lambda-cyhalothrin (Lambda) has been the most commonly used insecticide for control of rice stink bug, due to it being highly efficacious and cost effective for growers. Other chemical options, such as dinotefuran (Tenchu), are effective for control of rice stink bug but are cost prohibitive for growers. This raises concern for the longevity of products such as Lambda, and resistance monitoring is needed. New control options for rice stink bug need to be evaluated if resistance to Lambda is documented in the mid-South. A large block experiment was conducted at two locations in 2019, and one location in 2020 to compare Lambda and Tenchu for efficacy and residual control of rice stink bug. Sweep net sampling was performed pre-application, and every 2-3 days post-application for two weeks to monitor stink bug populations. No differences were observed between products at any location in regard to efficacy and residual. Additionally, assays were conducted on select populations of rice stink bug. The tested populations were collected from fields where large numbers of rice stink bugs were found soon after an application of Lambda. Rice stink bug collections were made in Poinsett County (2019) and Crittenden and Chicot Counties (2020). Lambda was applied to petri dishes at five different rates with an untreated for comparison. Each treatment was replicated ten times. Dishes were allowed to dry then five rice stink bugs were placed in each dish. Mortality was assessed at 24 hours after infestation. Assay results indicate that resistance of rice stink bug to Lambda may be a developing issue for Arkansas rice producers.

Introduction

Rice stink bug 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 residual control. Lambda-cyhalothrin (Lambda) is the most commonly used insecticide when applications are required. This product has been highly efficacious and cost effective for growers. Dinotefuran (Tenchu) is another reliable insecticide for the control of rice stink bug, but the high price compared to Lambda prohibits widespread adoption of this product. While lambda continues to be the primary insecticide used for control of rice stink bug, there is concerns regarding the development of insecticide resistance. This has driven research to begin testing alternative products for rice stink bug suppression, while developing and implementing other IPM practices.

Methods

Large Block Efficacy Trial

A large block experiment was conducted in Lincoln County (2019) and Arkansas County (2019 and 2020), to compare Lambda (Warrior II) and Tenchu for efficacy and residual control of rice stink bug. Fields were split into two 25-acre plots, with one plot receiving Tenchu at 8 oz/a and one plot receiving Lambda at 1.82 oz/a. All applications were made with an airplane calibrated to 3 gallons per acre. Sweep net sampling was performed pre-application, and every 2-3 days post-application for two weeks to monitor rice stink bug populations.

Insecticide Resistance Bioassay

Bioassays were conducted on select populations of rice stink bug. The tested populations were collected from fields with high populations of rice stink bug were found soon after an application of Lambda. Rice stink bug collections were made in Poinsett County in 2019, and Crittenden and Chicot Counties in 2020. 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. Dishes were allowed to dry then five rice stink bugs were placed in each dish. Mortality was assessed at 24 hours after infestation.

Results

Large Block Study

No differences were observed at any location between Lambda and Tenchu with respect to rice stink bug efficacy or residual control. At the Lincoln County (2019) location, both products exceeded the rice stink bug threshold at 6 day after initial application. A second application was made, and after the second application both products reduced rice stink bug densities below threshold for the remainder of the season (Figure 1). At both Arkansas County locations (2019 and 2020), both products effectively controlled rice stink bug with a single application. This data suggest that the products are relatively similar regarding efficacy and residual.

Bioassay Study

In 2019 in Poinsett County, all treatments exceeding the 0.25X rate provided greater control of rice stink bug when compared to the 0.25X rate or UTC. Lambda applied at the 4X rate resulted in the greatest control when compared to all other treatments tested. Plots receiving a 1X rate resulted in 40% mortality of the tested population, and a 4X rate was required to achieve 100% mortality (Figure 2). At Chicot County, AR (2020), no treatment achieved 100% mortality, all treatments had increased mortality compared to the untreated check with increased mortality at the 1.0, 2.0 and 4.0X rates compared to the 0.25X and 0.5X rates. No differences were observed between 1X, 2X, & 4X rates of lambda for mortality of rice stink bugs (Figure 3). At the Crittenden County, AR location no differences were observed for any rate of Lambda, however all rates of lambda showed an increase in mortality compared to the untreated check (Figure 4) with a maximum level of mortality of less than 60%.

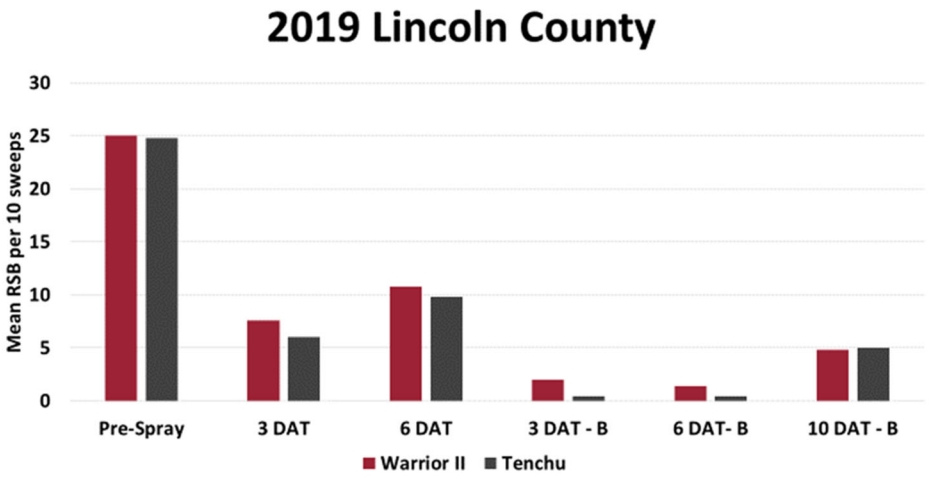

Figure 1. Large block comparison of Lambda and Tenchu applications for control of rice stink bug in Lincoln County, AR 2019

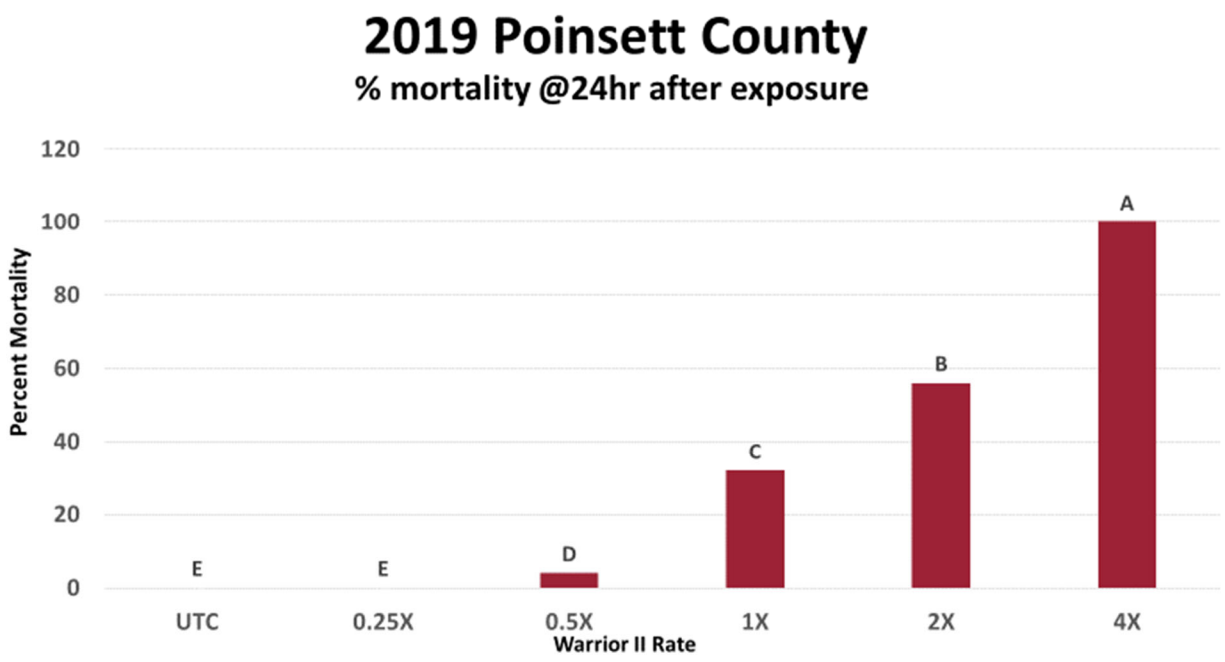

Figure 2. Efficacy of Lambda for rice stink bug at multiple rates 24 hours after exposure. Poinsett County, AR 2019.

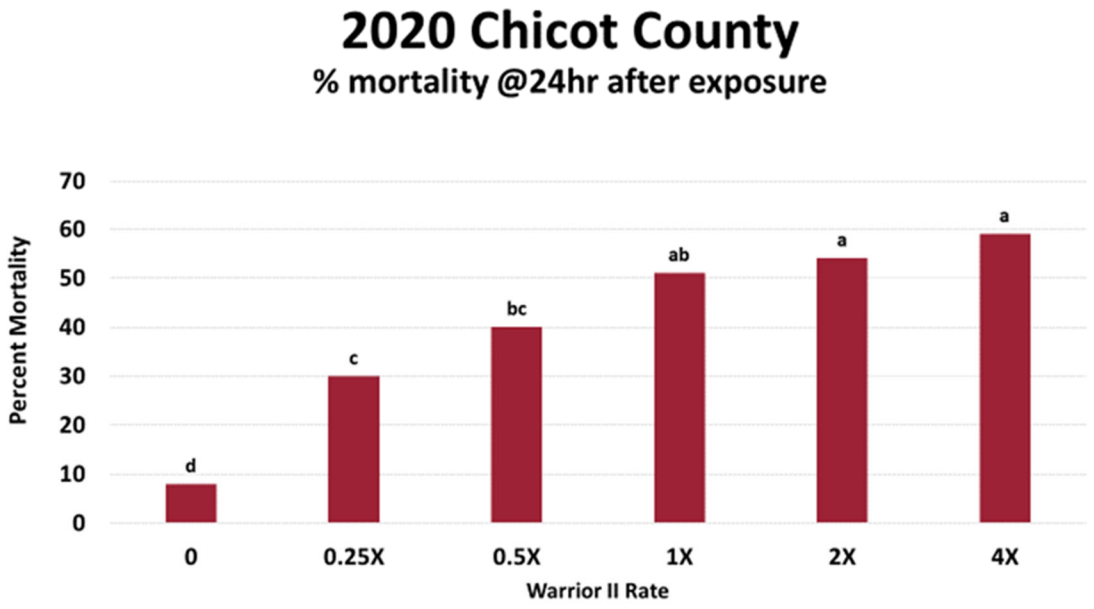

Figure 3. Efficacy of Lambda for rice stink bug at multiple rates 24 hours after exposure. Chicot County, AR 2020.

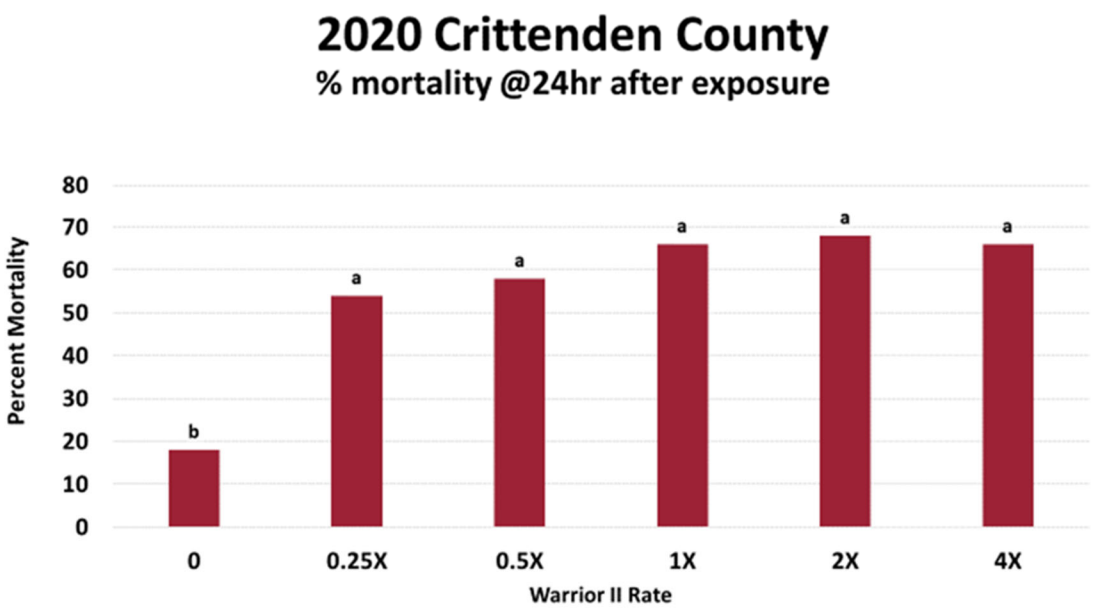

Figure 4. Efficacy of Lambda for rice stink bugs at multiple rates 24 hours after exposure. Crittenden County, AR 2020.

Summary

Applications of lambda-cyhalothrin should still be implemented until a more cost-efficient product is available. Assay results indicate that resistance/tolerance of rice stink bugs to lambda may be a developing issue for Arkansas rice producers. All populations that were tested behind failed Lambda applications were late in the growing season and no problems with Lambda were observed prior to September. Further research to monitor resistant populations is imperative. If rice stink bug nymphs are found after lambda application, rotating to Tenchu is recommended.

Acknowledgements

We would like to thank the Arkansas Rice Promotion Board for funding this research through the Arkansas Rice Checkoff, as well as, cooperating producers.