



2019 Rice Insect Losses in the United States

**Bateman, N.R.^{*1}, G.M. Lorenz², B.C. Thrash², J. Gore³, M.O. Way⁴, B.E. Wilson⁵,
L.A. Espino⁶, and M.T. Vanweelden⁷**

¹University of Arkansas, Cooperative Extension Service, 2900 HWY 130 E, Stuttgart, AR 72160.

²University of Arkansas CES, Lonoke Extension Center, ³Mississippi State University, Delta Research and Extension Center, ⁴Texas A&M University, Beaumont Center, ⁵Louisiana State University Agricultural Center, Baton Rouge, ⁶University of California ANR CES, Oroville, and ⁷University of Florida, Everglades Research and Education Center

*corresponding author email: nbateman@uada.edu

Abstract

Estimates of the costs and losses associated with multiple insect pests of rice were compiled for 6 rice-producing states. Participating states included Arkansas, California, Florida, Louisiana, Mississippi, and Texas, accounting for approximately 90% of the rice grown in the US. Overall, insects accounted for nearly \$269 million in costs and losses during 2019, averaging \$113.43 per acre. Rice water weevil caused more yield loss than all other insect pests across all participating states, followed by rice stink bug and rice billbug.

Key Words: rice, yield loss, pest management

Introduction

Rice has major economic impacts in some areas of the US, and has been documented to have negative impacts from insect feeding. Multiple insect pests feed on rice throughout the growing season, and in some cases can cause severe yield losses (Bowling, 1959, and Swanson and Newsom, 1962). Rice insect loss estimates have been made annually since 2017 (Bateman et al., 2020) to document changes in pest populations, control tactics, and impacts throughout the rice-growing regions of the US.

Material and Methods

During the fall of 2019, impacts of insect pests in rice were estimated. Rice growers, crop consultants, university specialists, and

retailers were informally contacted by an author about their experiences with rice insect pests for the 2019 growing season. Acreage, yield, and price values were obtained from the National Agriculture Statistical Survey (NASS USDA 2019). An estimate of pure line and hybrid rice acreage were obtained, as well as row rice acreage were included. A new state, Florida, was added to the estimates as well. All data were processed in an Excel spreadsheet similar to Musser et al. (2008).

Results and Discussion

In 2019, there were 2.36 million acres (1 acre=0.405 hectare) represented in the estimates from the 6 contributing states. These acres accounted for 93% of the 2.55 million acres planted in the US during 2019. Foliar

applications targeting insect pests ranged from 0.01 in California to 1.35 in Mississippi, with an average of 0.69 applications per acre across all states. Growers lost approximately \$113.43 per acre due to yield losses and control cost of insect pests in rice during 2019 (Table 1).

During 2019, 66% of the total rice acreage in the survey had insecticide seed treatment on the seed (Table 1). Over 50% of the pureline acres received an insecticide seed treatment, however over 100% of the hybrid rice acres were treated with insecticide seed treatment (Appendix 1). This is similar to the trend observed in 2018 (Bateman et al., 2021) where growers are using two classes of (neonicotinoid and diamide) insecticide seed treatments to improve control of pests such as rice water weevil (*Lissorhoptus oryzophilus*, Kuschel), armyworms (Family: Noctuidae), and the stem borer complex (Family: Crambidae).

Across all rice producing states, an estimated 3.54% yield loss were attributed to insects. Rice water weevil caused more yield loss than all other insect pests during 2019. Rice stink bug (*Oebalus pugnax*, F.) caused the second highest amount of yield loss and required more foliar applications than all other pests. Rice billbug (*Sphenophorus pertinax*, Chittenden) caused more damage per acre infested than all other insect pests, however it only infested 8.5% of the total rice acreage.

State Highlights

Arkansas. Rice water weevil and rice stink bug cost growers more than all other pests due to yield loss and cost of control. Approximately 50% of the total rice acres received a foliar application for rice stink bug. An increase in rice billbug infested acres was observed, most likely due to the increase in row rice.

California. Tadpole shrimp infested more acres than all other insect pests in California during 2019, however armyworms caused the most yield loss per acre infested than all other insect pests.

Florida. Rice stink bug, rice delphacid, and rice water weevil were the dominate insect pests of rice during the 2019 growing season in Florida. Of these pests, rice stink bug had the largest economic impact.

Louisiana. Rice stink bug and rice water weevil infested the most amount of rice acres in Louisiana during 2019, with Rice water weevil causing the largest amount of yield loss. A large percentage of the acres were infest with multiple stem borer species. South American rice miner was also observed on approximately 5% of the rice acres.

Mississippi. Rice water weevil, rice stink bug, and rice billbug caused more damage per acre infested than all other pests in rice in Mississippi. Fall armyworm infested 30% of the acres however only 10% exceeded economic

Table 1. Insect management practices for multiple rice growing states in the US for 2019.

State	Scouted*	Insecticide Seed Treatment*	Total Foliar Applications/acre	Costs+Losses†
Arkansas	80%	80%	0.83	\$64.07
California	80%	0%	0.01	\$38.37
Florida	0%	0%	1.21	\$91.84
Louisiana	70%	90%	0.31	\$89.42
Mississippi	100%	89%	1.35	\$48.66
Texas	50%	100%	0.91	\$92.52
Average (weighted by acreage)	77%	66%	0.69	\$113.43

*Percent of acreage

†Dollars per acre

threshold.

Texas. Rice water weevil and rice stink bug infested more acres than all other insect pests of rice in Texas. An average of 1.5 applications per acre were required to control rice stink bug. Rice delphacid was observed on 10% of the rice acres.

Acknowledgements

The authors would like to thank numerous faculty, crop consultants, and extension personnel in each state who provided input into these estimates. Without their input, these estimates would not be possible.

References

- Bateman, N.R., G.M. Lorenz, B.C. Thrash, J. Gore, M.O. Way, B.E. Wilson, L.A. Espino, and F.R. Musser.** 2017 Rice insect losses in the United States. *Midsouth Entomol.* 13-1 24-32.
- Bateman, N.R., G.M. Lorenz, B.C. Thrash, J. Gore, M.O. Way, B.E. Wilson, L.A. Espino, and M.T. VanWeeldon.** 2018 Rice insect losses in the United States. *Midsouth Entomol.* Submitted.
- Bowling, C.C.** 1959. A comparison of three methods of insecticide application for control of the rice water weevil. *J. Econ. Entomol.* 52: 767.
- Musser, F.R., and A. Catchot.** 2008. Mississippi soybean insect losses. *Midsouth Entomol.* 1: 29-36.
- Swanson, M.C., and L.D., Newsom.** 1962. Effect of infestation by the Rice Stink Bug, *Oebalus pugnax*, on yield and quality in rice. *J. Econ. Entomol.* 55:877-879.
- USDA NASS.** 2017. United States Department of Agriculture National Agricultural Statistics Service, Data and Statistics, <https://quickstats.nass.usda.gov/>

Appendix 1. Overall rice insect losses from 5 surveyed states, 2019.

Combined in the year 2019

Pest	Acres Infested	% Acres Infested	Acres above ET	% Acres above ET	Acres Treated	% Acres Treated	# of apps/ acres treated	Cost of 1 Insecticide	% loss per acre infested	# of apps per total rice acres	Overall % reduction	bushel lost per pest	Loss + Cost	Loss + Cost/acre	% Total Loss + Cost
Aphids	302,779	12.8%	0	0.0%	0	0.0%	0.00	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Bilbug	202,133	8.5%	27,983	1.2%	0	0.0%	0.00	\$0.00	1.13	0.000	0.10%	399,559	\$6,050,956	\$2.56	2.5%
Chinch Bug	305,238	12.9%	59,279	2.5%	59,279	2.5%	1.00	\$10.04	0.01	0.025	0.00%	7,143	\$703,422	\$0.30	0.3%
Fall Armyworm	329,365	13.9%	72,419	3.1%	72,419	3.1%	1.00	\$9.47	0.28	0.031	0.04%	163,433	\$3,161,196	\$1.34	1.3%
Grape Colaspis	569,208	24.1%	139,320	5.9%	0	0.0%	0.00	\$0.00	0.93	0.000	0.22%	918,319	\$13,907,097	\$5.88	5.7%
Leafhoppers	428,950	18.1%	174,150	7.4%	0	0.0%	0.00	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Longhorned Grasshopper	1,814,298	76.7%	2,320	0.1%	1,160	0.0%	1.10	\$8.50	0.01	0.001	0.00%	19,219	\$301,906	\$0.13	0.1%
Mexican Rice Borer	176,937	7.5%	15,892	0.7%	7,700	0.3%	1.00	\$4.84	0.83	0.003	0.06%	255,011	\$3,899,177	\$1.65	1.6%
Rice Delphacid	34,260	1.4%	1,540	0.1%	15,400	0.7%	1.00	\$17.09	0.45	0.007	0.01%	26,858	\$669,930	\$0.28	0.3%
Rice Seed Midge	215,108	9.1%	0	0.0%	0	0.0%	0.00	\$0.00	0.20	0.000	0.02%	75,931	\$1,149,910	\$0.49	0.5%
Rice Stalk Borer	229,459	9.7%	0	0.0%	0	0.0%	0.00	\$0.00	0.24	0.000	0.02%	94,689	\$1,433,981	\$0.61	0.6%
Rice Stink Bug	1,857,777	78.6%	789,833	33.4%	903,403	38.2%	1.13	\$11.61	1.33	0.431	1.05%	4,318,232	\$77,236,954	\$32.66	31.7%
Rice Water Weevil	1,859,337	78.6%	630,308	26.7%	208,160	8.8%	1.00	\$11.59	2.47	0.088	1.94%	8,012,211	\$123,751,086	\$52.34	50.9%
Shorthorned Grasshopper	253,239	10.7%	34,830	1.5%	23,220	1.0%	1.00	\$10.00	0.02	0.010	0.00%	10,124	\$385,521	\$0.16	0.2%
South American Rice Miner	20,479	0.9%	0	0.0%	0	0.0%	0.00	\$0.00	0.50	0.000	0.00%	17,858	\$270,443	\$0.11	0.1%
Sugarcane Borer	93,075	3.9%	0	0.0%	0	0.0%	0.00	\$0.00	0.09	0.000	0.00%	14,286	\$216,354	\$0.09	0.1%
Tadpole Shrimp	161,910	6.8%	150,300	6.4%	150,300	6.4%	1.00	\$27.00	0.46	0.064	1.72	131,065	\$6,042,958	\$2.56	2.5%
Thrips	259,765	11.0%	0	0.0%	0	0.0%	0.00	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
True Armyworm	118,172	5.0%	40,080	1.7%	61,710	2.6%	1.00	\$31.11	0.72	0.026	0.04%	147,680	\$4,156,175	\$1.76	1.7%
Wireworms/Other grubs	116,100	4.9%	0	0.0%	0	0.0%	0.00	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
TOTAL							0.685	\$9.33			3.54%	14,611,619	\$243,337,067	\$102.91	100.0%

SUMMARY DATA

Data Input		Seed Treatment Breakdown			Yield & Management Results		Economic Results		
State	Combined	% of Acres	# of Acres	Price/Acre	Total Bushels Harvested	397,780,936	Total	Per Acre	
Year	2019				Total Bushels Lost to Insects	14,611,619	\$22,057,484	\$9.33	
Total Acres	2,364,577				Percent Yield Loss	3.54%	\$11,243,634	\$4.76	
% Pureline	64%	Pureline			Yield w/o Insects	174.40	\$13,642,912	\$5.77	
% Hybrid	40%	Nipst Suite	9%	139,462	Ave. # Spray Applications	0.685	\$46,944,030	\$19.85	
% Acres of Row Rice	5%	CruiserMaxx	23%	346,027	Seed Treated Acres	1,554,659	\$221,279,583	\$93.58	
Pureline Seeding Rate lbs/acre	84	Dermacor X-100	21%	320,096	Scouted Acres	1,809,304	\$268,223,613	\$113.43	
Hybrid Seeding Rate lbs/acre	16	Fortenza	0%	0					
Yield (bushels/acre)	168	Untreated	47%	718,358					
Price/Bushel	\$15.14	Hybrid							
% Acres Scouted	77%	Nipst Suite	81%	772,808					
Scouting Fee/scouted acre	\$7.54	CruiserMaxx	26%	252,636					
% Acres Insect Seed Trt.	66%	Dermacor X-100	7%	66,900					
Avg. Seed Trt Cost/treated ac	\$7.23	Fortenza	2%	14,396					
		Untreated	0.1%	690					

Appendix 4. Florida rice insect losses in 2019.

Florida in the year 2019

Pest	Acres Infested	% Acres Infested	Acres above ET	% Acres above ET	Acres Treated	% Acres Treated	# of apps/acres treated	Cost of 1 Insecticide	% loss per acre infested	# of apps per total rice acres	Overall % reduction	bushel lost per pest	Loss + Cost	Loss + Cost/acre	% Total Loss + Cost
Aphids	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Billbug	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Chinch Bug	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Fall Armyworm	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Grape Colaspis	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Leafhoppers	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Longhorned Grasshopper	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Mexican Rice Borer	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Rice Delphacid	18,860	82.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Rice Seed Midge	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Rice Stalk Borer	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Rice Stink Bug	23,000	100.0%	21,160	92.0%	18,630	81.0%	1.5	\$13.00	10.00	1.215	10.00%	296,444	\$2,112,307	\$91.84	100.0%
Rice Water Weevil	19,550	85.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Shorthorned Grasshopper	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
South American Rice Miner	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Sugarcane Borer	2,300	10.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Tadpole Shrimp	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Thrips	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
True Armyworm	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
Wireworms/Other grubs	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	0.00%	0	\$0	\$0.00	0.0%
TOTAL										1.215	10.00%	296,444	\$2,112,307	\$91.84	100.0%

SUMMARY DATA

Data Input		Seed Treatment Breakdown			Yield & Management Results			Economic Results							
State	FL		% of Acres	# of Acres	Price/Acre	Total Bushels Harvested	2,668,000	Total Bushels Lost to Insects	296,444	Foliar Insecticides Costs	\$363,285	Total	\$363,285	Per Acre	\$15.80
Year	2019	Pureline				Percent Yield Loss	10.00%	Yield w/o Insects	128.89	Seed Treatment Costs	\$0		\$0		\$0.00
Total Acres	23,000	Nipsit Suite				Ave. # Spray Applications	1.215	Seed Treated Acres	0	Scouting costs	\$0		\$0		\$0.00
% Pureline	97%	CruiserMaxx				Scouted Acres	0	Total Costs	\$363,285	Yield Lost to insects	\$1,749,022		\$1,749,022		\$76.04
% Hybrid	3%	Dermacor X-100				Total Losses + Costs	\$2,112,307		\$2,112,307		\$91.84				
% Acres of Row Rice	0%	Fortenza													
Pureline Seeding Rate lbs/acre	80	Untreated	100%	22,310	\$0.00										
Hybrid Seeding Rate lbs/acre	30	Hybrid													
Yield (bushels/acre)	116	Nipsit Suite													
Price/Bushel	\$5.90	CruiserMaxx													
% Acres Scouted	0%	Dermacor X-100													
Scouting Fee/scouted acre	\$0.00	Fortenza													
% Acres Insect Seed Trt.	0%	Untreated	100%	690	\$0.00										
Avg. Seed Trt Cost/treated ac	\$0.00														

Appendix 7. Texas rice insect losses in 2019.

Texas in the year 2019

Pest	Acres Infested	% Acres Infested	Acres above ET	% Acres above ET	Acres Treated	% Acres Treated	# of apps/acres treated	Cost of 1 Insecticide	% loss per acre infested	# of apps per total rice acres	cost/acre	Overall % reduction	bushel lost per pest	Loss + Cost	Loss + Cost/acre	% Total Loss + Cost
Aphids	38,500	25.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Billbug	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Chinch Bug	7,700	5.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Fall Armyworm	38,500	25.0%	1,540	1.0%	1,540	1.0%	1	\$13.84	1.00	0.010	\$0.14	0.25%	55,118	\$336,591	\$2.19	2.9%
Grape Colaspis	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Leafhoppers	115,500	75.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Longhorned Grasshopper	154,000	100.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Mexican Rice Borer	115,500	75.0%	7,700	5.0%	7,700	5.0%	1	\$4.84	1.00	0.050	\$0.24	0.75%	165,355	\$983,100	\$6.38	8.4%
Rice Delphacid	15,400	10.0%	1,540	1.0%	15,400	10.0%	1	\$17.09	1.00	0.100	\$1.71	0.10%	22,047	\$389,297	\$2.53	3.3%
Rice Seed Midge	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Rice Stalk Borer	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Rice Stink Bug	154,000	100.0%	77,000	50.0%	77,000	50.0%	1.5	\$21.38	5.00	0.750	\$16.04	5.00%	1,102,368	\$8,774,936	\$56.98	74.7%
Rice Water Weevil	154,000	100.0%	154,000	100.0%	0	0.0%	0	\$0.00	1.00	0.000	\$0.00	1.00%	220,474	\$1,261,109	\$8.19	10.7%
Shorthorned Grasshopper	115,500	75.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
South American Rice Miner	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Sugarcane Borer	7,700	5.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Tadpole Shrimp	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Thrips	15,400	10.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
True Armyworm	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Wireworms/Other grubs	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
TOTAL										0.910	\$18.12	7.10%	1,565,363	\$11,745,033	\$76.27	100.0%

SUMMARY DATA

Data Input		Seed Treatment Breakdown			Yield & Management Results		Economic Results		
State	TX		% of Acres	# of Acres	Price/Acre	Total Bushels Harvested	20,482,000	Total	Per Acre
Year	2019	Pureline				Total Bushels Lost to Insects	1,565,363	Foliar Insecticides Costs	\$2,791,158
Total Acres	154,000	Nipsit Suite	0%	0	\$0.00	Percent Yield Loss	7.10%	Seed Treatment Costs	\$1,348,144
% Pureline	50%	CruiserMaxx	0%	0	\$0.00	Yield w/o Insects	143.16	Scouting costs	\$1,155,000
% Hybrid	50%	Dermacon X-100	100%	77,000	\$14.83	Ave. # Spray Applications	0.910	Total Costs	\$5,294,301
% Acres of Row Rice	0%	Fortenza	0%	0	\$0.00	Seed Treated Acres	154,000	Yield Lost to insects	\$8,953,875
Pureline Seeding Rate lbs/acre	70	Untreated	0%	0	\$0.00	Scouted Acres	77,000	Total Losses + Costs	\$14,248,176
Hybrid Seeding Rate lbs/acre	20	Hybrid							
Yield (bushels/acre)	133	Nipsit Suite	93%	71,610	\$3.32				
Price/Bushel	\$5.72	CruiserMaxx	0%	0	\$0.00				
% Acres Scouted	50%	Dermacon X-100	7%	5,390	\$9.69				
Scouting Fee/scouted acre	\$15.00	Fortenza	0%	0	\$0.00				
% Acres Insect Seed Trt.	100%	Untreated	0%	0	\$0.00				
Avg. Seed Trt Cost/treated ac	\$8.75								