

2019 Rice Insect Losses in the United States

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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.

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

Material and Methods

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

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 (Lissorhoptrus oryzophilus, Kuschel), armyworms (Family: Noctuidae), and the stem borer complex (Family: Crambidae).

Across all rice producing states, an estimated 3.54% yield loss were atributed 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 acerage.

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

		Insecticide Seed	Total Foliar	
State	Scouted*	Treatment*	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	77%	66%	0.69	\$113.43
(weighted by acreage)				
*Dereent of core and				

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

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.

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

Combined in the year 2019

							# of		% loss	# of apps per						
		% Acres	Acres above	% Acres	Acres	% Acres	apps/acres	Cost of 1	per acre	total rice		Overall %	bushel lost		Loss +	% Total
Pest	Acres Infested	Infested	ET	above ET	Treated	Treated	treated	Insecticide	infested	acres	cost/acre	reduction	per pest	Loss + Cost	Cost/acre	Loss + Cost
Aphids	302,779	12.8%	0	0.0%	0	0.0%	0.00	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Billbug	202,133	8.5%	27,983	1.2%	0	0.0%	0.00	\$0.00	1.13	0.000	\$0.00	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	\$0.25	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	\$0.29	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	\$0.00	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	0.00%	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	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	\$0.02	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	\$0.11	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	\$0.00	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	\$0.00	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	\$5.01	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	\$1.02	1.94%	8,012,211	\$123,751,086	\$52.34	50.9%
Shorthonred Grasshopper	253,239	10.7%	34,830	1.5%	23,220	1.0%	1.00	\$10.00	0.02	0.010	\$0.10	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	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	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	0.03%	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	0.00%	0	S 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	\$0.81	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	0.00%	0	\$0	\$0.00	0.0%
									TOTAL	0.685	\$9.33	3.54%	14,611,619	\$243,337,067	\$102.91	100.0%

Data Input		See	d Treatmen	t Breakdow	n	Yield & Management	Results	Econon	nic Results	
State	Combined		% of Acres	# of Acres	Price/Acre	Total Bushels Harvested	397,780,936		Total	Per Acre
Year	2019	Pureline			Contraction of the second	Total Bushels Lost to Insects	14,611,619	Foliar Insecticides Costs	\$22,057,484	\$9.33
Total Acres	2,364,577	Nipslt Suite	9%	139,462	\$11.29	Percent Yield Loss	3.54%	Seed Treatment Costs	\$11,243,634	\$4.76
% Pureline	64%	CruiserMaxx	23%	346,027	\$14.78	Yield w/o Insects	174.40	Scouting costs	\$13,642,912	\$5.77
% Hybrid	40%	Dermacor X-100	21%	320,096	\$17.99	Ave. # Spray Applications	0.685	Total Costs	\$46,944,030	\$19.85
% Acres of Row Rice	5%	Fortenza	0%	0	\$0.00	Seed Treated Acres	1,554,659	Yield Lost to insects	\$221,279,583	\$93.58
Pureline Seeding Rate lbs/acre	84	Untreated	47%	718,358	\$0.00	Scouted Acres	1,809,304	Total Losses + Costs	\$268,223,613	\$113.43
Hybrid Seeding Rate lbs/acre	16					-		-		
Yield (bushels/acre)	168	Hybrid								
Price/Bushel	\$15.14	Nipslt Suite	81%	772,808	\$4.84					
% Acres Scouted	77%	CruiserMaxx	26%	252,636	\$7.00					
Scouting Fee/scouted acre	\$7.54	Dermacor X-100	7%	66,900	\$14.02					
% Acres Insect Seed Trt.	66%	Fortenza	2%	14,396	\$7.50					
Avg. Seed Trt Cost/treated ac	\$7.23	Untreated	0.1%	690	\$0.00					

Appendix 2. Arkansas rice insect losses in 2019.

Arkansas in the year 2019

							# of		% loss	# of apps per						
		% Acres	Acres above	% Acres	Acres	% Acres	apps/acres	Cost of 1	per acre	total rice		Overall %	bushel lost		Loss +	% Total
Pest	Acres Infested	Infested	ET	above ET	Treated	Treated	treated	Insecticide	infested	acres	cost/acre	reduction	per pest	Loss + Cost	Cost/acre	Loss + Cost
Aphids	232,200	20.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Billbug	174,150	15.0%	0	0.0%	0	0.0%	0	\$0.00	1.00	0.000	\$0.00	0.15%	302,814	\$1,623,083	\$1.40	2.7%
Chinch Bug	255,420	22.0%	58,050	5.0%	58,050	5.0%	1	\$10.00	0.00	0.050	\$0.50	0.00%	0	\$580,500	\$0.50	1.0%
Fall Armyworm	174,150	15.0%	58,050	5.0%	58,050	5.0%	1	\$10.00	0.25	0.050	\$0.50	0.04%	75,704	\$986,271	\$0.85	1.7%
Grape Colaspis	522,450	45.0%	139,320	12.0%	0	0.0%	0	\$0.00	1.00	0.000	\$0.00	0.45%	908,442	\$4,869,250	\$4.19	8.2%
Leafhoppers	290,250	25.0%	174,150	15.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	\$0	\$0.00	0.0%
Longhorned Grasshopper	1,161,000	100.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$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	0.00%	0	S0	\$0.00	0.0%
Rice Delphacid	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
Rice Seed Midge	174,150	15.0%	0	0.0%	0	0.0%	0	\$0.00	0.25	0.000	\$0.00	0.04%	75,704	\$405,771	\$0.35	0.7%
Rice Stalk Borer	208,980	18.0%	0	0.0%	0	0.0%	0	\$0.00	0.25	0.000	\$0.00	0.05%	90,844	\$486,925	\$0.42	0.8%
Rice Stink Bug	1,161,000	100.0%	464,400	40.0%	580,500	50.0%	1.1	\$10.75	1.00	0.550	\$5.91	1.00%	2,018,760	\$17,684,968	\$15.23	29.8%
Rice Water Weevil	1,161,000	100.0%	406,350	35.0%	174,150	15.0%	1	\$11.50	2.80	0.150	\$1.73	2.80%	5,652,529	\$32,300,280	\$27.82	54.4%
Shorthonred Grasshopper	116,100	10.0%	34,830	3.0%	23,220	2.0%	1	\$10.00	0.05	0.020	\$0.20	0.01%	10,094	\$286,303	\$0.25	0.5%
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	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%
Tadpole Shrimp	11,610	1.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
Thrips	58,050	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%
True Armyworm	34,830	3.0%	0	0.0%	11,610	1.0%	5 1	\$10.00	0.25	0.010	\$0.10	0.01%	15,141	\$197,254	\$0.17	0.3%
Wireworms/Other grubs	116,100	10.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
									TOTAL	0.830	\$8.94	4.53%	9,150,031	\$59,420,604	\$51.18	100.0%

Data Input		See	d Treatmen	t Breakdow	n
State	AR	0.0000	% of Acres	# of Acres	Price/Acre
Year	2019	Pureline			
Total Acres	1,161,000	Nipslt Suite	15%	83,592	\$11.00
% Pureline	48%	CruiserMaxx	50%	278,640	\$15.00
% Hybrid	62%	Dermacor X-100	0%	0	\$18.00
% Acres of Row Rice	8%	Fortenza	0%	0	\$18.00
Pureline Seeding Rate Ibs/acre	64	Untreated	35%	195,048	\$0.00
Hybrid Seeding Rate lbs/acre	20				
Yield (bushels/acre)	166	Hybrid			
Price/Bushel	\$5.36	Nipslt Suite	90%	647,838	\$5.00
% Acres Scouted	80%	CruiserMaxx	24%	172,757	\$7.00
Scouting Fee/scouted acre	\$9.50	Dermacor X-100	1%	7,198	\$14.40
% Acres Insect Seed Trt.	80%	Fortenza	2%	14,396	\$7.50
Avg. Seed Trt Cost/treated ac	\$6.62	Untreated	0%	0	\$0.00

Yield & Management	Results
Total Bushels Harvested	192,726,000
Total Bushels Lost to Insects	9,150,031
Percent Yield Loss	4.53%
Yield w/o Insects	173.88
Ave. # Spray Applications	0.830
Seed Treated Acres	928,800
Scouted Acres	928,800

Econom	ic Results	
	Total	Per Acre
Foliar Insecticides Costs	\$10,376,438	\$8.94
Seed Treatment Costs	\$6,144,835	\$5.29
Scouting costs	\$8,823,600	\$7.60
Total Costs	\$25,344,872	\$21.83
Yield Lost to insects	\$49,044,167	\$42.24
Total Losses + Costs	\$74,389,039	\$64.07

Appendix 3. California rice insect losses in 2019.

							# of		% loss	# of apps per						
		% Acres	Acres above	% Acres	Acres	% Acres	apps/acres	Cost of 1	per acre	total rice		Overall %	bushel lost		Loss +	% Total
Pest	Acres Infested	Infested	ET	above ET	Treated	Treated	treated	Insecticide	infested	acres	cost/acre	reduction	per pest	Loss + Cost	Cost/acre	Loss + Cost
Aphids	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%
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	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%
Fall 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%
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	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%
Longhorned Grasshopper	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%
Mexican Rice Borer	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
Rice Delphacid	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 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	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 Water Weevil	5,010	1.0%	0	0.0%	5,010	1.0%	1	\$27.00	0.00	0.010	\$0.27	0.00%	0	\$135,270	\$0.27	0.7%
Shorthonred Grasshopper	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%
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	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%
Tadpole Shrimp	150,300	30.0%	150,300	30.0%	150,300	30.0%	1	\$27.00	0.50	0.300	\$8.10	0.15%	141,707	\$10,671,571	\$21.30	55.5%
Thrips	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%
True Armyworm	75,150	15.0%	40,080	8.0%	50,100	10.0%	1	\$36.00	1.00	0.100	\$3.60	0.15%	141,707	\$8,417,071	\$16.80	43.8%
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	0.010	\$11.97	0.30%	283,414	\$19,223,913	\$38.37	100.0%

California in the year 2019

Data Input		See	d Treatment	Breakdow	'n	Yield & Management	Results	Econom	nic Results	
State	CA		% of Acres	# of Acres	Price/Acre	Total Bushels Harvested	94,188,000		Total	Per Acre
Year	2019	Pureline				Total Bushels Lost to Insects	283,414	Foliar Insecticides Costs	\$5,996,970	\$11.97
Total Acres	501,000	Nipslt Suite				Percent Yield Loss	0.30%	Seed Treatment Costs	\$0	\$0.00
% Pureline	100%	CruiserMaxx				Yield w/o Insects	188.57	Scouting costs	50	\$0.00
% Hybrid	0%	Dermacor X-100	6			Ave. # Spray Applications	0.010	Total Costs	\$5,996,970	\$11.97
% Acres of Row Rice	0%	Fortenza				Seed Treated Acres	0	Yield Lost to insects	\$13,226,943	\$26.40
Pureline Seeding Rate lbs/acre	160	Untreated	100%	501,000	\$0.00	Scouted Acres	400,800	Total Losses + Costs	\$19,223,913	\$38.37
Hybrid Seeding Rate lbs/acre	0					. .	10	10-10-10-10-10-10-10-10-10-10-10-10-10-1		
Yield (bushels/acre)	188	Hybrid								
Price/Bushel	\$46.67	Nipslt Suite								
% Acres Scouted	80%	CruiserMaxx								
Scouting Fee/scouted acre	\$0.00	Dermacor X-100	i,							
% Acres Insect Seed Trt.	0%	Fortenza								
Avg. Seed Trt Cost/treated ac	\$0.00	Untreated								

Appendix 4. Florida rice insect losses in 2019.

Florida in the year 2019

							# of		% loss	# of apps per						
		% Acres	Acres above	% Acres	Acres	% Acres	apps/acres	Cost of 1	per acre	total rice		Overall %	bushel lost		Loss +	% Total
Pest	Acres Infested	Infested	ET	above ET	Treated	Treated	treated	Insecticide	infested	acres	cost/acre	reduction	per pest	Loss + Cost	Cost/acre	Loss + Cost
Aphids	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%
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	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%
Fall 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%
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	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%
Longhorned Grasshopper	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%
Mexican Rice Borer	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$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	0.00%	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	0.00%	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	23,000	100.0%	21,160	92.0%	18,630	81.0%	1.5	\$13.00	10.00	1.215	\$15.80	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	0.00%	0	\$0	\$0.00	0.0%
Shorthonred Grasshopper	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	S0	\$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	2,300	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%
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	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%
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	1.215	\$15.80	10.00%	296,444	\$2,112,307	\$91.84	100.0%

Data Input State		See	d Treatment	Breakdow	'n	Yield & Management	t Results	Econe	omic Results	
State	FL		% of Acres	# of Acres	Price/Acre	Total Bushels Harvested	2,668,000		Total	Per Acre
Year	2019	Pureline				Total Bushels Lost to Insects	296,444	Foliar Insecticides Costs	\$363,285	\$15.80
Total Acres	23,000	Nipslt Suite				Percent Yield Loss	10.00%	Seed Treatment Costs	\$0	\$0.00
% Pureline	97%	CruiserMaxx				Yield w/o Insects	128.89	Scouting costs	\$0	\$0.00
% Hybrid	3%	Dermacor X-100				Ave. # Spray Applications	1.215	Total Costs	\$363,285	\$15.80
% Acres of Row Rice	0%	Fortenza				Seed Treated Acres	0	Yield Lost to insects	\$1,749,022	\$76.04
Pureline Seeding Rate lbs/acre	80	Untreated	100%	22,310	\$0.00	Scouted Acres	0	Total Losses + Costs	\$2,112,307	\$91.84
Hybrid Seeding Rate lbs/acre	30									
Yield (bushels/acre)	116	Hybrid								
Price/Bushel	\$5.90	Nipslt Suite								
% Acres Scouted	0%	CruiserMaxx								
Scouting Fee/scouted acre	\$0.00	Dermacor X-100								
% Acres Insect Seed Trt.	0%	Fortenza								
Avg. Seed Trt Cost/treated ac	\$0.00	Untreated	100%	690	\$0.00					

Appendix 5. Louisiana rice insect losses in 2019.

Louisiana in the year 2019

							# of	_	% loss	# of apps per						
		% Acres	Acres above	% Acres	Acres	% Acres	apps/acres	Cost of 1	per acre	total rice		Overall %	bushel lost		Loss +	% Total
Pest	Acres Infested	Infested	ET	above ET	Treated	Treated	treated	Insecticide	infested	acres	cost/acre	reduction	per pest	Loss + Cost	Cost/acre	Loss + Cost
Aphids	20,479	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%
Billbug	16,383	4.0%	16,383	4.0%	0	0.0%	0	\$0.00	3.00	0.000	\$0.00	0.12%	85,377	\$956,223	\$2.33	3.5%
Chinch Bug	40,958	10.0%	1,229	0.3%	1,229	0.3%	1	\$12.00	0.10	0.003	\$0.04	0.01%	7,115	\$94,430	\$0.23	0.3%
Fall Armyworm	81,915	20.0%	1,229	0.3%	1,229	0.3%	1	\$12.00	0.10	0.003	\$0.04	0.02%	14,230	\$174,115	\$0.43	0.6%
Grape Colaspis	40,958	10.0%	0	0.0%	0	0.0%	0	\$0.00	0.10	0.000	\$0.00	0.01%	7,115	\$79,685	\$0.19	0.3%
Leafhoppers	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%
Longhorned Grasshopper	389,098	95.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
Mexican Rice Borer	61,437	15.0%	8,192	2.0%	0	0.0%	0	\$0.00	0.50	0.000	\$0.00	0.08%	53,361	\$597,639	\$1.46	2.2%
Rice Delphacid	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
Rice Seed Midge	40,958	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%
Rice Stalk Borer	20,479	5.0%	0	0.0%	0	0.0%	0	\$0.00	0.10	0.000	\$0.00	0.01%	3,557	\$39,843	\$0.10	0.1%
Rice Stink Bug	409,577	100.0%	122,873	30.0%	122,873	30.0%	1	\$12.00	0.50	0.300	\$3.60	0.50%	355,738	\$5,458,740	\$13.33	19.7%
Rice Water Weevil	409,577	100.0%	40,958	10.0%	0	0.0%	0	\$0.00	2.50	0.000	\$0.00	2.50%	1,778,689	\$19,921,316	\$48.64	71.9%
Shorthonred Grasshopper	20,479	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%
South American Rice Miner	20,479	5.0%	0	0.0%	0	0.0%	0	\$0.00	0.50	0.000	\$0.00	0.03%	17,787	\$199,213	\$0.49	0.7%
Sugarcane Borer	81,915	20.0%	0	0.0%	0	0.0%	0	\$0.00	0.10	0.000	\$0.00	0.02%	14,230	\$159,371	\$0.39	0.6%
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	81,915	20.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
True Armyworm	8,192	2.0%	0	0.0%	0	0.0%	0	\$0.00	0.10	0.000	\$0.00	0.00%	1,423	\$15,937	\$0.04	0.1%
Wireworms/Other grubs	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
									TOTAL	0.306	\$3.67	3.29%	2,338,620	\$27,696,513	\$67.62	100.0%

Data Input		Seed Treatment Breakdown						
State	LA		% of Acres	# of Acres	Price/Acre			
Year	2019	Pureline						
Total Acres	409,577	Nipslt Suite	5%	15,154	\$15.00			
% Pureline	74%	CruiserMaxx	15%	45,463	\$15.00			
% Hybrid	26%	Dermacor X-100	80%	242,470	\$19.00			
% Acres of Row Rice	4%	Fortenza	0%	0	\$0.00			
Pureline Seeding Rate Ibs/acre	60	Untreated	0%	0	\$0.00			
Hybrid Seeding Rate lbs/acre	20							
Yield (bushels/acre)	168	Hybrid						
Price/Bushel	\$11.20	Nipslt Suite	0%	0	\$5.00			
% Acres Scouted	70%	CruiserMaxx	70%	74,543	\$7.00			
Scouting Fee/scouted acre	\$8.50	Dermacor X-100	50%	53,245	\$14.40			
% Acres Insect Seed Trt.	90%	Fortenza	0%	0	\$0.00			
Avg. Seed Trt Cost/treated ac	\$17.61	Untreated	0%	0	\$0.00			

Yield & Management F	Results	Economic Results						
Total Bushels Harvested	68,808,936		Total	Per Acre				
Total Bushels Lost to Insects	2,338,620	Foliar Insecticides Costs	\$1,503,967	\$3.67				
Percent Yield Loss	3.29%	Seed Treatment Costs	\$6,492,865	\$15.85				
Yield w/o Insects	173.71	Scouting costs	\$2,436,983	\$5.95				
Ave. # Spray Applications	0.306	Total Costs	\$10,433,815	\$25.47				
Seed Treated Acres	368,619	Yield Lost to insects	\$26,192,546	\$63.95				
Scouted Acres	286,704	Total Losses + Costs	\$36,626,361	\$89.42				

Appendix 6. Mississippi rice insect losses in 2019.

Mississippi in the year 2019

							# of		% loss	# of apps per						
		% Acres	Acres above	% Acres	Acres	% Acres	apps/acres	Cost of 1	per acre	total rice		Overall %	bushel lost		Loss +	% Total
Pest	Acres Infested	Infested	ET	above ET	Treated	Treated	treated	Insecticide	infested	acres	cost/acre	reduction	per pest	Loss + Cost	Cost/acre	Loss + Cost
Aphids	11,600	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%
Billbug	11,600	10.0%	11,600	10.0%	0	0.0%	0	\$0.00	0.50	0.000	\$0.00	0.05%	9,701	\$50,253	\$0.43	1.3%
Chinch Bug	1,160	1.0%	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	34,800	30.0%	11,600	10.0%	11,600	10.0%	1	\$6.00	0.10	0.100	\$0.60	0.03%	5,821	\$99,752	\$0.86	2.6%
Grape Colaspis	5,800	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%
Leafhoppers	23,200	20.0%	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	110,200	95.0%	2,320	2.0%	1,160	1.0%	1.1	\$8.50	0.10	0.011	\$0.09	0.10%	18,433	\$106,327	\$0.92	2.7%
Mexican Rice Borer	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$0.00	0.0%
Rice Delphacid	0	0.0%	0	0.0%	0	0.0%	0	\$0.00	0.00	0.000	\$0.00	0.00%	0	50	\$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	0.00%	0	50	\$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	110,200	95.0%	104,400	90.0%	104,400	90.0%	1.1	\$8.50	1.00	0.990	\$8.42	0.95%	184,326	\$1,930,950	\$16.65	49.6%
Rice Water Weevil	110,200	95.0%	29,000	25.0%	29,000	25.0%	5 1	\$9.50	1.50	0.250	\$2.38	1.43%	276,489	\$1,707,716	\$14.72	43.8%
Shorthonred Grasshopper	1,160	1.0%	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	1,160	1.0%	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	50	\$0.00	0.0%
Thrips	104,400	90.0%	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	50	\$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	1.351	\$11.48	2.55%	494,771	\$3,894,998	\$33.58	100.0%

Data Input		Seed Treatment Breakdown						
State	MS		% of Acres	# of Acres	Price/Acre			
Year	2019	Pureline						
Total Acres	116,000	Nipslt Suite	65%	40,716	\$10.50			
% Pureline	54%	CruiserMaxx	35%	21,924	\$11.50			
% Hybrid	46%	Dermacor X-100	1%	626	\$14.82			
% Acres of Row Rice	8%	Fortenza	0%	0	\$20.00			
Pureline Seeding Rate Ibs/acre	65	Untreated	0%	0	\$0.00			
Hybrid Seeding Rate lbs/acre	26							
Yield (bushels/acre)	163	Hybrid						
Price/Bushel	\$5.18	Nipslt Suite	100%	53,360	\$5.00			
% Acres Scouted	100%	CruiserMaxx	10%	5,336	\$7.00			
Scouting Fee/scouted acre	\$8.50	Dermacor X-100	2%	1,067	\$14.40			
% Acres Insect Seed Trt.	89%	Fortenza	0%	0	\$8.00			
Avg. Seed Trt Cost/treated ac	\$7.39	Untreated	0%	0	\$0.00			

Yield & Management F	lesults	Economic Results						
Total Bushels Harvested	18,908,000		Total	Per Acre				
Total Bushels Lost to Insects	494,771	Foliar Insecticides Costs	\$1,332,086	\$11.48				
Percent Yield Loss	2.55%	Seed Treatment Costs	\$763,312	\$6.58				
Yield w/o Insects	167.27	Scouting costs	\$986,000	\$8.50				
Ave. # Spray Applications	1.351	Total Costs	\$3,081,398	\$26.56				
Seed Treated Acres	103,240	Yield Lost to insects	\$2,562,912	\$22.09				
Scouted Acres	116,000	Total Losses + Costs	\$5,644,309	\$48.66				

Texas in the year 2019

Appendix 7. Texas rice insect losses in 2019.

Pest	Acres Infested	% Acres	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	50	\$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%	5 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	50	\$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%
Shorthonred 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	50	\$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	50	\$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	S0	\$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	50	\$0.00	0.0%
									TOTAL	0.910	\$18.12	7.10%	1,565,363	\$11,745,033	\$76.27	100.0%

Data Input		Seed Treatment Breakdown						
State	TX	1.000	% of Acres	# of Acres	Price/Acre			
Year	2019	Pureline						
Total Acres	154,000	Nipslt Suite	0%	0	\$0.00			
% Pureline	50%	CruiserMaxx	0%	0	\$0.00			
% Hybrid	50%	Dermacor X-100	100%	77,000	\$14.83			
% Acres of Row Rice	0%	Fortenza	0%	0	\$0.00			
Pureline Seeding Rate Ibs/acre	70	Untreated	0%	0	\$0.00			
Hybrid Seeding Rate lbs/acre	20							
Yield (bushels/acre)	133	Hybrid						
Price/Bushel	\$5.72	Nipslt Suite	93%	71,610	\$3.32			
% Acres Scouted	50%	CruiserMaxx	0%	0	\$0.00			
Scouting Fee/scouted acre	\$15.00	Dermacor X-100	7%	5,390	\$9.69			
% Acres Insect Seed Trt.	100%	Fortenza	0%	0	\$0.00			
Avg. Seed Trt Cost/treated ac	\$8.75	Untreated	0%	0	\$0.00			

Yield & Management F	Results	Economic Results					
Total Bushels Harvested	20,482,000		Total	Per Acre			
Total Bushels Lost to Insects	1,565,363	Foliar Insecticides Costs	\$2,791,158	\$18.12			
Percent Yield Loss	7.10%	Seed Treatment Costs	\$1,348,144	\$8.75			
Yield w/o Insects	143.16	Scouting costs	\$1,155,000	\$7.50			
Ave. # Spray Applications	0.910	Total Costs	\$5,294,301	\$34.38			
Seed Treated Acres	154,000	Yield Lost to insects	\$8,953,875	\$58.14			
Scouted Acres	77,000	Total Losses + Costs	\$14,248,176	\$92.52			