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2020 Rice Insect Losses in the United States

Bateman, N.R.*[1], G.M. Lorenz[2], B.C. Thrash[2], J. Gore[3], M.O. Way[4], B.E. Wilson[5], L.A. Espino[6], and M.T. Vanweelden[7]

[1]University of Arkansas, Cooperative Extension Service, 2900 HWY 130 E, Stuttgart, AR 72160. [2]University of Arkansas CES, Lonoke Extension Center, [3]Mississippi State University, Delta Research and Extension Center, [4]Texas A&M University, Beaumont Center, [5]Louisiana State University Agricultural Center, Baton Rouge, [6]University of California Cooperative Extension, Butte County, and [7]University of Florida, Everglades Research and Education Center
*corresponding author email: nbateman@uada.edu

Abstract

Insects have the potential to reduce quality and yield in rice throughout the US. It is important to document these reductions over time to determine shifts in control costs and pest densities. 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, which account for approximately 90% of the rice grown in the US. Overall, insects accounted for over $340 million in costs and losses during 2020, averaging over $120 per acre. Rice water weevil and rice stink bug accounted for over 70% of the total losses plus costs estimates for 2020.

Key Words: yield loss, pest management, insecticide

Introduction

Rice is a major economic crop in several states throughout the US. There are multiple insect pests that feed on rice, which can lead to both yield and quality losses (Way, M.O, 2003). 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

At the end of the 2020 growing season losses from rice insects were estimated. These estimates were made by the authors from informal contact with rice growers, crop consultants, university specialists, and retailers about their experiences with rice insect pests for the 2020 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 estimated row rice acreage. All data were processed in an Excel spreadsheet similar to Musser et al. (2008).

Results and Discussion

In 2020, there were 2.83 million acres (1 acre=0.405 hectare) represented in the estimates from the 6 contributing states. These acres accounted for 93% of the 3.04 million acres planted in the US during 2020. Foliar

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applications targeting insect pests ranged from 0.01 in California to 1.25 in Florida, with an average of 0.69 applications per acre across all states. Growers lost approximately $120.36 per acre due to yield losses and control cost of insect pests in rice during 2020 (Table 1). Overall 2020 was similar to 2018 (Bateman et al., 2021) and 2019 (Bateman et al., 2021) with respect to overall yield reduction and costs of control.

A general increase of overall acres with an insecticide seed treatment was observed for 2020, with 71% of the total acres having at least one insecticide seed treatment (Table 1). Slightly over 50% of the pureline acres received an insecticide seed treatment. However, 100% of the hybrid rice acres received an insecticide seed treatment and 7% of these acres had multiple insecticide seed treatments applied to the seed (Appendix 1). This is similar to the trend observed in 2018 and 2019 (Bateman et al., 2021a, and Bateman et al., 2021b) where growers are using two classes of insecticide seed treatments (neonicotinoid and diamide) to improve control of pests such as rice water weevil (*Lissorhoptrus oryzophilus*, Kuschel), armyworms (Family: Noctuidae), and the stem borer complex (Family: Crambidae).

An estimated 3.85% yield loss was attributed to insects across all survey states. Rice water weevil caused more yield loss than all other insect pests during 2020. Rice stink bug (*Oebalus pugnax*, F.) caused the second highest amount of yield loss and required more foliar applications than all other pests. Foliar applications for insect pests attacking rice averaged $8.83 per acre with an average of 0.69 applications per acre.

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. Only 40% of the total rice acres received a foliar application for rice stink bug, down from previous years. Rice billbug infested acres increased along with the increase in row rice acres.

California. Tadpole shrimp infested more acres and received more foliar applications than all other insect pests in California during 2020, 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 2020 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 rice acres in Louisiana during 2020, with rice water weevil causing the greatest yield loss. A large percentage of the acres were infested with multiple stem borer species. South American rice miner was observed but on a low percentage of the rice acres.

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	85%	85%	0.82	$72.68
California	80%	0%	0.01	$39.21
Florida	0%	0%	1.25	$89.61
Louisiana	70%	90%	0.31	$90.70
Mississippi	100%	97%	1.07	$42.67
Texas	50%	100%	0.93	$127.36
Average (weighted by acreage)	80%	71%	0.69	$120.36

*Percent of acreage

†Dollars per acre

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 15% of the acres which was lower than previous years.

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 which is similar to previous years.

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Appendix 1: Overall rice insect losses from 6 surveyed states, 2020.

Combined in the year 2020

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	344,360	12.2%	1,800	0.1%	1,800	0.1%	1.00	$15.88	0.14	0.001	$0.01	0.02%	82,388	$1,211,299	$0.43	0.4%
Billbug	565,065	20.0%	32,637	1.2%	3,400	0.1%	1.00	$8.50	1.11	0.001	$0.01	0.22%	1,091,349	$15,695,743	$5.56	5.3%
Chinch Bug	401,793	14.2%	76,040	2.7%	47,058	1.7%	1.00	$10.29	0.12	0.017	$0.17	0.02%	86,526	$1,726,134	$0.61	0.6%
Fall Armyworm	434,089	15.4%	125,208	4.4%	154,428	5.5%	1.00	$9.95	0.29	0.055	$0.54	0.05%	222,123	$4,726,002	$1.67	1.6%
Grape Colaspis	781,493	27.7%	262,980	9.3%	0	0.0%	0.00	$0.00	0.94	0.000	$0.00	0.26%	1,278,530	$18,353,924	$6.50	6.2%
Leafhoppers	551,250	19.5%	220,850	7.8%	1,700	0.1%	1.00	$6.00	0.00	0.001	$0.00	0.00%	0	$10,200	$0.00	0.0%
Longhorned Grasshopper	2,254,631	79.8%	3,400	0.1%	3,400	0.1%	1.25	$8.50	0.01	0.002	$0.01	0.01%	28,083	$439,270	$0.16	0.1%
Mexican Rice Borer	206,389	7.3%	18,519	0.7%	9,000	0.3%	1.00	$4.38	0.83	0.003	$0.01	0.06%	296,818	$4,300,385	$1.52	1.5%
Rice Delphacid	37,024	1.3%	1,800	0.1%	18,000	0.6%	1.00	$19.59	0.49	0.006	$0.12	0.01%	31,300	$801,945	$0.28	0.3%
Rice Seed Midge	339,793	12.0%	0	0.0%	43,830	1.6%	0.00	$0.00	0.21	0.000	$0.00	0.03%	127,025	$1,823,512	$0.65	0.6%
Rice Stalk Borer	359,826	12.7%	73,050	2.6%	584,400	20.7%	1.00	$10.00	0.24	0.207	$2.07	0.03%	150,217	$8,000,441	$2.83	2.7%
Rice Stink Bug	2,277,317	80.6%	894,799	31.7%	672,722	23.8%	1.10	$12.03	1.31	0.262	$3.15	1.05%	5,179,897	$83,272,319	$29.47	28.1%
Rice Water Weevil	2,306,981	81.7%	837,493	29.6%	59,860	2.1%	1.00	$10.68	2.47	0.021	$0.23	2.02%	9,916,624	$142,997,038	$50.61	48.3%
Shorthonred Grasshopper	308,296	10.9%	73,050	2.6%	29,220	1.0%	1.00	$10.00	0.02	0.010	$0.10	0.00%	12,703	$474,551	$0.17	0.2%
South American Rice Miner	71,389	2.5%	0	0.0%	0	0.0%	0.00	$0.00	0.50	0.000	$0.00	0.01%	62,069	$891,025	$0.32	0.3%
Sugarcane Borer	25,577	0.9%	1,700	0.1%	1,700	0.1%	1.00	$6.50	0.05	0.001	$0.00	0.00%	2,246	$43,298	$0.02	0.0%
Tadpole Shrimp	168,810	6.0%	154,200	5.5%	154,200	5.5%	1.00	$27.00	0.46	0.055	$1.47	0.03%	134,068	$6,088,010	$2.15	2.1%
Thrips	339,235	12.0%	0	0.0%	0	0.0%	0.00	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
True Armyworm	236,119	8.4%	143,390	5.1%	124,450	4.4%	1.00	$20.74	0.49	0.044	$0.91	0.04%	199,236	$5,441,027	$1.93	1.8%
Wireworms/Other grubs	146,100	5.2%	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**	**$8.83**	**3.85%**	**18,901,201**	**$296,296,124**	**$104.87**	**100.0%**

SUMMARY DATA

Data Input

State	Combined
Year	2020
Total Acres	2,825,317
% Pureline	53%
% Hybrid	47%
% Acres of Row Rice	13%
Pureline Seeding Rate lbs/acre	82
Hybrid Seeding Rate lbs/acre	17
Yield (bushels/acre)	167
Price/Bushel	$14.36
% Acres Scouted	80%
Scouting Fee/scouted acre	$7.82
% Acres Insect Seed Trt.	71%
Avg. Seed Trt Cost/treated ac	$8.24

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite	11%	165,629	$11.31
CruiserMaxx	18%	266,927	$14.73
Dermacor X-100	23%	345,607	$17.91
Fortenza	1%	9,935	$18.00
Untreated	47%	706,416	$0.00
Hybrid			
NipsIt Suite	22%	298,739	$4.80
CruiserMaxx	70%	936,447	$6.95
Dermacor X-100	9%	121,536	$13.95
Fortenza	6%	79,398	$7.57
Untreated	0.04%	488	$0.00

Yield & Management Results

Total Bushels Harvested	472,388,581
Total Bushels Lost to Insects	18,901,201
Percent Yield Loss	3.85%
Yield w/o Insects	173.89
Ave. # Spray Applications	0.685
Seed Treated Acres	2,015,084
Scouted Acres	2,246,199

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$24,960,215	$8.83
Seed Treatment Costs	$16,595,789	$5.87
Scouting costs	$17,565,506	$6.22
Total Costs	$59,121,511	$20.93
Yield Lost to insects	$271,335,909	$96.04
Total Losses + Costs	$330,457,420	$116.96

Appendix 2: Arkansas rice insect losses

Arkansas in the year 2020

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	262,980	18.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Billbug	511,350	35.0%	0	0.0%	0	0.0%	0	$0.00	1.00	0.000	$0.00	0.35%	897,365	$5,186,767	$3.55	6.2%
Chinch Bug	292,200	20.0%	73,050	5.0%	43,830	3.0%	1	$10.00	0.00	0.030	$0.30	0.00%	0	$438,300	$0.30	0.5%
Fall Armyworm	292,200	20.0%	116,880	8.0%	146,100	10.0%	1	$10.00	0.25	0.100	$1.00	0.05%	128,195	$2,201,967	$1.51	2.6%
Grape Colaspis	730,500	50.0%	262,980	18.0%	0	0.0%	0	$0.00	1.00	0.000	$0.00	0.50%	1,281,949	$7,409,667	$5.07	8.8%
Leafhoppers	365,250	25.0%	219,150	15.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Longhorned Grasshopper	1,461,000	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	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 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	292,200	20.0%	0	0.0%	43,830	3.0%	0	$0.00	0.25	0.000	$0.00	0.05%	128,195	$740,967	$0.51	0.9%
Rice Stalk Borer	336,030	23.0%	73,050	5.0%	584,400	40.0%	1	$10.00	0.25	0.400	$4.00	0.06%	147,424	$6,696,112	$4.58	8.0%
Rice Stink Bug	1,461,000	100.0%	511,350	35.0%	292,200	20.0%	1	$10.75	1.00	0.200	$2.15	1.00%	2,563,899	$17,960,484	$12.29	21.4%
Rice Water Weevil	1,461,000	100.0%	584,400	40.0%	29,220	2.0%	1	$11.45	2.80	0.020	$0.23	2.80%	7,178,916	$41,828,704	$28.63	49.8%
Shorthonred Grasshopper	146,100	10.0%	73,050	5.0%	29,220	2.0%	1	$10.00	0.05	0.020	$0.20	0.01%	12,819	$366,297	$0.25	0.4%
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	14,610	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%
Thrips	73,050	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	146,100	10.0%	102,270	7.0%	73,050	5.0%	1	$10.00	0.25	0.050	$0.50	0.03%	64,097	$1,100,983	$0.75	1.3%
Wireworms/Other grubs	146,100	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%
									TOTAL	**0.820**	**$8.38**	**4.84%**	**12,402,859**	**$83,930,247**	**$57.45**	**100.0%**

SUMMARY DATA

Data Input

State	AR
Year	2020
Total Acres	1,461,000
% Pureline	34%
% Hybrid	66%
% Acres of Row Rice	20%
Pureline Seeding Rate lbs/acre	65
Hybrid Seeding Rate lbs/acre	21
Yield (bushels/acre)	167
Price/Bushel	$5.78
% Acres Scouted	85%
Scouting Fee/scouted acre	$9.50
% Acres Insect Seed Trt.	85%
Avg. Seed Trt Cost/treated ac	$8.43

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite	25%	124,185	$11.00
CruiserMaxx	40%	198,696	$15.00
Dermacor X-100	0%	0	$18.00
Fortenza	2%	9,935	$18.00
Untreated	33%	163,924	$0.00
Hybrid			
NipsIt Suite	15%	144,639	$5.00
CruiserMaxx	80%	771,408	$7.00
Dermacor X-100	3%	28,928	$14.40
Fortenza	7%	67,498	$7.50
Untreated	0%	0	$0.00

Yield & Management Results

Total Bushels Harvested	243,987,000
Total Bushels Lost to Insects	12,402,859
Percent Yield Loss	4.84%
Yield w/o Insects	175.49
Ave. # Spray Applications	0.820
Seed Treated Acres	1,241,850
Scouted Acres	1,241,850

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$12,241,719	$8.38
Seed Treatment Costs	$10,462,616	$7.16
Scouting costs	$11,797,575	$8.08
Total Costs	$34,501,910	$23.62
Yield Lost to insects	$71,688,528	$49.07
Total Losses + Costs	$106,190,438	$72.68

Appendix 3: California rice insect losses, 2020.

California in the year 2020

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	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	$0	$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	5,140	1.0%	0	0.0%	5,140	1.0%	1	$27.00	0.00	0.010	$0.27	0.00%	0	$138,780	$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	154,200	30.0%	154,200	30.0%	154,200	30.0%	1	$27.00	0.50	0.300	$8.10	0.15%	150,024	$11,165,023	$21.72	55.4%
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	77,100	15.0%	41,120	8.0%	51,400	10.0%	1	$36.00	1.00	0.100	$3.60	0.15%	150,024	$8,852,023	$17.22	43.9%
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%**	**300,048**	**$20,155,827**	**$39.21**	**100.0%**

SUMMARY DATA

Data Input

State	CA
Year	2020
Total Acres	514,000
% Pureline	100%
% Hybrid	0%
% Acres of Row Rice	0%
Pureline Seeding Rate lbs/acre	160
Hybrid Seeding Rate lbs/acre	0
Yield (bushels/acre)	194
Price/Bushel	$46.67
% Acres Scouted	80%
Scouting Fee/scouted acre	$0.00
% Acres Insect Seed Trt.	0%
Avg. Seed Trt Cost/treated ac	$0.00

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite			
CruiserMaxx			
Dermacor X-100			
Fortenza			
Untreated	100%	514,000	$0.00
Hybrid			
NipsIt Suite			
CruiserMaxx			
Dermacor X-100			
Fortenza			
Untreated			

Yield & Management Results

Total Bushels Harvested	99,716,000
Total Bushels Lost to Insects	300,048
Percent Yield Loss	0.30%
Yield w/o Insects	194.58
Ave. # Spray Applications	0.010
Seed Treated Acres	0
Scouted Acres	411,200

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$6,152,580	$11.97
Seed Treatment Costs	$0	$0.00
Scouting costs	$0	$0.00
Total Costs	$6,152,580	$11.97
Yield Lost to insects	$14,003,247	$27.24
Total Losses + Costs	$20,155,827	$39.21

Appendix 4: Florida rice insect losses, 2020.

Florida in the year 2020

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	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	$0	$0.00	0.0%
Rice Delphacid	19,024	78.0%	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	24,390	100.0%	23,171	95.0%	20,244	83.0%	1.5	$13.00	10.00	1.245	$16.19	10.00%	319,780	$2,185,520	$89.61	100.0%
Rice Water Weevil	23,414	96.0%	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	$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	3,659	15.0%	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	**1.245**	**$16.19**	**10.00%**	**319,780**	**$2,185,520**	**$89.61**	**100.0%**

SUMMARY DATA

Data Input

State	FL
Year	2020
Total Acres	24,390
% Pureline	98%
% Hybrid	2%
% Acres of Row Rice	0%
Pureline Seeding Rate lbs/acre	80
Hybrid Seeding Rate lbs/acre	30
Yield (bushels/acre)	118
Price/Bushel	$5.60
% Acres Scouted	0%
Scouting Fee/scouted acre	$0.00
% Acres Insect Seed Trt.	0%
Avg. Seed Trt Cost/treated ac	$0.00

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite			
CruiserMaxx			
Dermacor X-100			
Fortenza			
Untreated	100%	23,902	$0.00
Hybrid			
NipsIt Suite			
CruiserMaxx			
Dermacor X-100			
Fortenza			
Untreated	100%	488	$0.00

Yield & Management Results

Total Bushels Harvested	2,878,020
Total Bushels Lost to Insects	319,780
Percent Yield Loss	10.00%
Yield w/o Insects	131.11
Ave. # Spray Applications	1.245
Seed Treated Acres	0
Scouted Acres	0

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$394,752	$16.19
Seed Treatment Costs	$0	$0.00
Scouting costs	$0	$0.00
Total Costs	$394,752	$16.19
Yield Lost to insects	$1,790,768	$73.42
Total Losses + Costs	$2,185,520	$89.61

Appendix 5: Louisiana rice insect losses, 2020.

Louisiana in the year 2020

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	2,380	0.5%	0	0.0%	0	0.0%	0	$0.00	1.00	0.000	$0.00	0.01%	3,523	$45,799	$0.10	0.1%
Billbug	33,315	7.0%	19,037	4.0%	0	0.0%	0	$0.00	3.00	0.000	$0.00	0.21%	147,965	$1,923,545	$4.04	5.8%
Chinch Bug	47,593	10.0%	1,190	0.3%	1,428	0.3%	1	$12.00	0.10	0.003	$0.04	0.01%	7,046	$108,731	$0.23	0.3%
Fall Armyworm	71,389	15.0%	1,428	0.3%	1,428	0.3%	1	$12.00	0.10	0.003	$0.04	0.02%	10,569	$154,529	$0.32	0.5%
Grape Colaspis	47,593	10.0%	0	0.0%	0	0.0%	0	$0.00	0.10	0.000	$0.00	0.01%	7,046	$91,597	$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	452,131	95.0%	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	71,389	15.0%	9,519	2.0%	0	0.0%	0	$0.00	0.50	0.000	$0.00	0.08%	52,845	$686,980	$1.44	2.1%
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	47,593	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	23,796	5.0%	0	0.0%	0	0.0%	0	$0.00	0.10	0.000	$0.00	0.01%	3,523	$45,799	$0.10	0.1%
Rice Stink Bug	475,927	100.0%	142,778	30.0%	142,778	30.0%	1	$12.00	0.50	0.300	$3.60	0.50%	352,298	$6,293,206	$13.22	19.1%
Rice Water Weevil	475,927	100.0%	47,593	10.0%	0	0.0%	0	$0.00	2.50	0.000	$0.00	2.50%	1,761,488	$22,899,346	$48.12	69.4%
Shorthonred Grasshopper	23,796	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	71,389	15.0%	0	0.0%	0	0.0%	0	$0.00	0.50	0.000	$0.00	0.08%	52,845	$686,980	$1.44	2.1%
Sugarcane Borer	9,519	2.0%	0	0.0%	0	0.0%	0	$0.00	0.10	0.000	$0.00	0.00%	1,409	$18,319	$0.04	0.1%
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	95,185	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%
True Armyworm	9,519	2.0%	0	0.0%	0	0.0%	0	$0.00	0.10	0.000	$0.00	0.00%	1,409	$18,319	$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	$0	$0.00	0.0%
									TOTAL	**0.306**	**$3.67**	**3.41%**	**2,401,965**	**$32,973,152**	**$69.28**	**100.0%**

SUMMARY DATA

Data Input

State	LA
Year	2020
Total Acres	475,927
% Pureline	67%
% Hybrid	33%
% Acres of Row Rice	8%
Pureline Seeding Rate lbs/acre	60
Hybrid Seeding Rate lbs/acre	20
Yield (bushels/acre)	143
Price/Bushel	$13.00
% Acres Scouted	70%
Scouting Fee/scouted acre	$8.50
% Acres Insect Seed Trt.	90%
Avg. Seed Trt Cost/treated ac	$17.19

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite	5%	15,944	$15.00
CruiserMaxx	15%	47,831	$15.00
Dermacor X-100	80%	255,097	$19.00
Fortenza	0%	0	$0.00
Untreated	0%	0	$0.00
Hybrid			
NipsIt Suite	0%	0	$5.00
CruiserMaxx	70%	109,939	$7.00
Dermacor X-100	50%	78,528	$14.40
Fortenza	0%	0	$0.00
Untreated	0%	0	$0.00

Yield & Management Results

Total Bushels Harvested	68,057,561
Total Bushels Lost to Insects	2,401,965
Percent Yield Loss	3.41%
Yield w/o Insects	148.05
Ave. # Spray Applications	0.306
Seed Treated Acres	428,334
Scouted Acres	333,149

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$1,747,604	$3.67
Seed Treatment Costs	$7,361,786	$15.47
Scouting costs	$2,831,766	$5.95
Total Costs	$11,941,156	$25.09
Yield Lost to insects	$31,225,548	$65.61
Total Losses + Costs	$43,166,704	$90.70

Appendix 6: Mississippi rice insect losses, 2020.

Mississippi in the year 2020

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	34,000	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	20,400	12.0%	13,600	8.0%	3,400	2.0%	1	$8.50	0.80	0.020	$0.17	0.10%	27,599	$176,833	$1.04	3.6%
Chinch Bug	17,000	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%
Fall Armyworm	25,500	15.0%	5,100	3.0%	5,100	3.0%	1	$6.00	0.10	0.030	$0.18	0.02%	4,312	$53,715	$0.32	1.1%
Grape Colaspis	3,400	2.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$0.00	0.0%
Leafhoppers	51,000	30.0%	1,700	1.0%	1,700	1.0%	1	$6.00	0.00	0.010	$0.06	0.00%	0	$10,200	$0.06	0.2%
Longhorned Grasshopper	161,500	95.0%	3,400	2.0%	3,400	2.0%	1.25	$8.50	0.10	0.025	$0.21	0.10%	27,312	$182,517	$1.07	3.7%
Mexican Rice Borer	0	0.0%	0	0.0%	0	0.0%	0	$0.00	0.00	0.000	$0.00	0.00%	0	$0	$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	136,000	80.0%	127,500	75.0%	127,500	75.0%	1.1	$6.50	1.00	0.825	$5.36	0.80%	229,996	$2,144,402	$12.61	43.4%
Rice Water Weevil	161,500	95.0%	25,500	15.0%	25,500	15.0%	1	$6.50	1.50	0.150	$0.98	1.43%	409,680	$2,361,635	$13.89	47.8%
Shorthonred Grasshopper	3,400	2.0%	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	3,400	2.0%	1,700	1.0%	1,700	1.0%	1	$6.50	0.10	0.010	$0.07	0.00%	575	$14,132	$0.08	0.3%
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	153,000	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	3,400	2.0%	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	**1.070**	**$7.03**	**2.43%**	**699,475**	**$4,943,434**	**$29.08**	**100.0%**

SUMMARY DATA

Data Input

State	MS
Year	2020
Total Acres	170,000
% Pureline	30%
% Hybrid	70%
% Acres of Row Rice	20%
Pureline Seeding Rate lbs/acre	65
Hybrid Seeding Rate lbs/acre	20
Yield (bushels/acre)	165
Price/Bushel	$5.36
% Acres Scouted	100%
Scouting Fee/scouted acre	$8.50
% Acres Insect Seed Trt.	97%
Avg. Seed Trt Cost/treated ac	$5.25

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite	50%	25,500	$10.50
CruiserMaxx	40%	20,400	$11.50
Dermacor X-100	1%	510	$14.82
Fortenza	0%	0	$20.00
Untreated	9%	4,590	$0.00
Hybrid			
NipsIt Suite	100%	119,000	$5.00
CruiserMaxx	10%	11,900	$7.00
Dermacor X-100	2%	2,380	$14.40
Fortenza	10%	11,900	$8.00
Untreated	0%	0	$0.00

Yield & Management Results

Total Bushels Harvested	28,050,000
Total Bushels Lost to Insects	699,475
Percent Yield Loss	2.43%
Yield w/o Insects	169.11
Ave. # Spray Applications	1.070
Seed Treated Acres	164,900
Scouted Acres	170,000

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$1,194,250	$7.03
Seed Treatment Costs	$865,906	$5.09
Scouting costs	$1,445,000	$8.50
Total Costs	$3,505,156	$20.62
Yield Lost to insects	$3,749,184	$22.05
Total Losses + Costs	$7,254,341	$42.67

Appendix 7: Texas rice insect losses, 2020.

Texas in the year 2020

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	45,000	25.0%	1,800	1.0%	1,800	1.0%	1	$15.88	1.00	0.010	$0.16	0.25%	80,357	$426,352	$2.37	2.7%
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	45,000	25.0%	1,800	1.0%	1,800	1.0%	1	$15.88	1.00	0.010	$0.16	0.25%	80,357	$426,352	$2.37	2.7%
Fall Armyworm	45,000	25.0%	1,800	1.0%	1,800	1.0%	1	$15.88	1.00	0.010	$0.16	0.25%	80,357	$426,352	$2.37	2.7%
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	135,000	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	180,000	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	135,000	75.0%	9,000	5.0%	9,000	5.0%	1	$4.38	1.00	0.050	$0.22	0.75%	241,071	$1,232,724	$6.85	7.8%
Rice Delphacid	18,000	10.0%	1,800	1.0%	18,000	10.0%	1	$19.59	1.00	0.100	$1.96	0.10%	32,143	$511,727	$2.84	3.2%
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	180,000	100.0%	90,000	50.0%	90,000	50.0%	1.5	$23.88	5.00	0.750	$17.91	5.00%	1,607,143	$11,179,157	$62.11	70.8%
Rice Water Weevil	180,000	100.0%	180,000	100.0%	0	0.0%	0	$0.00	1.00	0.000	$0.00	1.00%	321,429	$1,591,071	$8.84	10.1%
Shorthonred Grasshopper	135,000	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	9,000	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	18,000	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	**0.930**	**$20.56**	**7.60%**	**2,442,857**	**$15,793,735**	**$87.74**	**100.0%**

SUMMARY DATA

Data Input

State	TX
Year	2020
Total Acres	180,000
% Pureline	50%
% Hybrid	50%
% Acres of Row Rice	0%
Pureline Seeding Rate lbs/acre	70
Hybrid Seeding Rate lbs/acre	20
Yield (bushels/acre)	165
Price/Bushel	$4.95
% Acres Scouted	50%
Scouting Fee/scouted acre	$15.00
% Acres Insect Seed Trt.	100%
Avg. Seed Trt Cost/treated ac	$10.48

Seed Treatment Breakdown

	% of Acres	# of Acres	Price/Acre
Pureline			
NipsIt Suite	0%	0	$0.00
CruiserMaxx	0%	0	$0.00
Dermacor X-100	100%	90,000	$14.83
Fortenza	0%	0	$0.00
Untreated	0%	0	$0.00
Hybrid			
NipsIt Suite	39%	35,100	$3.32
CruiserMaxx	48%	43,200	$6.00
Dermacor X-100	13%	11,700	$9.69
Fortenza	0%	0	$0.00
Untreated	0%	0	$0.00

Yield & Management Results

Total Bushels Harvested	29,700,000
Total Bushels Lost to Insects	2,442,857
Percent Yield Loss	7.60%
Yield w/o Insects	178.57
Ave. # Spray Applications	0.930
Seed Treated Acres	180,000
Scouted Acres	90,000

Economic Results

	Total	Per Acre
Foliar Insecticides Costs	$3,701,592	$20.56
Seed Treatment Costs	$1,887,277	$10.48
Scouting costs	$1,350,000	$7.50
Total Costs	$6,938,869	$38.55
Yield Lost to insects	$12,092,143	$67.18
Total Losses + Costs	$19,031,012	$105.73