Rice Leaf

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Summary of 2019 University of California rice variety trial

Every year, the University of California Cooperative Extension, in cooperation with the Rice Experiment Station (RES), conducts rice variety trials in several locations of the Sacramento Valley (Fig. 1). Three broad variety categories are included in the trials:

Preliminary breeding lines: those that have been selected by RES breeders to be evaluated on a statewide basis because of promising characteristics observed at the RES. They are tested in two- replication trials.

Advanced breeding lines: these lines are more promising; typically, they have been tested first as preliminary. The best of the best may undergo seed increase and be considered for release as new rice varieties after several years of testing. Current commercial varieties are compared with these lines.

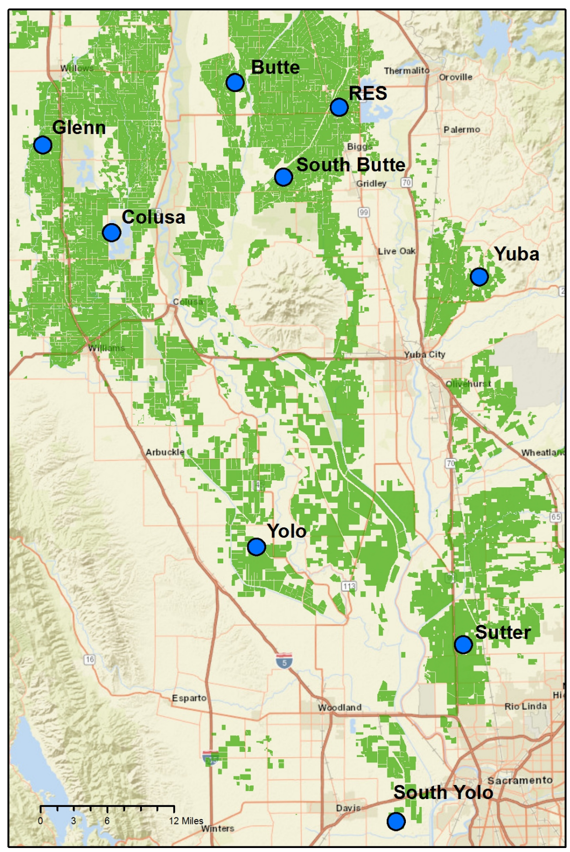

Fig. 1. Location of the UCCE and RES variety trials (RES=Rice Experiment Station)

The trials were conducted at the RES and eight farm locations across the Sacramento Valley, representing the main production areas of the Valley. Plots 200 ft^2 were hand seeded at a rate of 150 lbs/a, and grower cooperators treated the

Table 1. Yield (lbs/a) from variety trials conducted at eight locations across the Sacramento Valley and at the Rice Experiment Station (RES) in Biggs, 2019. For more details, go to the UC Rice On-line website (http://rice.ucanr.edu).

Varieties	Sutter	Yolo	South Yolo	Yuba	Butte	Colusa	South Butte	Glenn	RES
M-105	9,770	9,720	8,590	7,170	9,820	9,430	9,220	9,940	9,653
M-206	9,150	8,940	8,510	7,760	9,660	9,380	8,970	8,950	9,133
M-209	9,370	9,120	7,780	6,990	9,180	9,320	9,120	9,310	9,603
M-210	9,300	9,050	8,740	7,450	10,020	9,100	9,820	9,490	8,843
M-211	10,160	9,650	8,220	7,070	10,060	9,830	8,930	9,460	9,753
S-102	8,400	8,670	9,290	6,590	8,840	8,870	8,750	8,780	8,513
S-202	9,890	10,270	9,300	7,540	10,050	9,980	9,970	11,070	10,157
L-206	10,010	9,510	8,010	8,180	8,720	9,970	8,890	10,080	9,767
L-207	10,820	9,470	8,790	8,500	10,390	10,890	9,750	9,760	10,747
L-208	11,100	10,230	9,820	8,770	11,420	11,300	10,130	10,630	11,233
CJ-201	10,320	8,090	8,220	7,200	9,230	10,210	8,510	9,460	9,930
A-202	9,630	9,200	7,770	7,640	9,500	9,890	9,220	9,720	9,787
CA-201	6,710	8,160	7,280	6,040	6,650	7,930	7,440	7,740	6,200

trial in the same manner as the rest of the field. Parameters evaluated in the trials included seedling vigor, days to 50% heading, plant height, lodging at harvest, grain moisture at harvest, and grain yield at 14% moisture. In this summary, only yields are presented. All other parameters are inlcudd in the complete report, available on our website, UC Rice On-line at http://rice.ucanr.edu.

Fungicide treatment timings for control of rice diseases

A common question I get regarding fungicide treatments is what is the best timing for application. The best timing will depend on the disease one is targeting. Below are some recommendations based on three years of fungicide trials.

Stem rot

Stem rot is probably the most common disease present in rice fields. At the end of the season, the pathogen produces sclerotia, which are small round black structures that survive in the straw and constitute the inoculum for the disease the following season. The severity of the disease is directly proportional to the amount of sclerotia present in the soil, so it is important to minimize the accumulation of sclerotia in the soil by decomposing straw.

Fungicides can reduce the severity of the disease. Trials have shown that azoxystrobin, the active ingredient in Quadris and other fungicides, is effective in reducing the severity of the disease. As shown in table 2, application at the mid boot or early heading stage reduced the severity of the stem rot more than applications at mid tillering (about 35 to 45 days after seeding, the propanil timing).

Aggregate sheath spot

This disease is common in rice fields, but severe infections that result in yield reductions are rare. However, there are some areas where this disease could be important. For example, plants deficient in potassium are more susceptible to aggregate sheath spot; with all the baling going on, and removal of potassium with the straw, we could start seeing more problems with this disease.

Similar to stem rot, aggregate sheath spot produces sclerotia that remain in straw residue and infect plants the following season. In the fungicide trials, azoxystrobin reduced the severity of the disease the most when applied at the mid boot or early heading stage.

A new fungicide that may be available in 2021, inpyrfluxam, is really good at reducing the severity of aggregate sheath spot, reaching high levels of disease severity reduction when applied at the mid boot or early heading stage. Unfortunately, this fungicide does not seem to have activity against against stem rot.

Kernel smut

This disease has emerged as a serious problem in the northern part of the Valley, and we saw severe problems during 2018. Last year, the disease was present in many fields but it did not reach high severity. The fungicide propiconazole, the active ingredient in Tilt, has activity against this disease. Trials conducted in 2018 and 2019 indicate that the best timing for application is the mid boot stage.

Blast

Last year was a bad blast year for the northern part of the Valley. Azoxystrobin (Quadris) and trifloxystrobin (Stratego) have been extensively tested in the past and are effective in reducing disease severity when applied at early heading. Typically, a treatment is not recommended for leaf blast; the presence of leaf blast can be taken as a sign that a treatment will be needed during the early heading stage.

Last year, a trial was conducted to see if treating for blast at the mid boot stage could reduce the disease severity. Treatment with azoxystrobin or trifloxystrobin at this timing resulted in 80 to 90% reduction in the number of blasted panicles with respect to untreated plots. However, disease pressure at the location of the trial was low. More trials are needed to confidently recommend the mid boot stage timing for blast prevention.

Table 2. Average percentage disease severity reduction (number of trials) in fungicide trials conducted in the Sacramento Valley between 2017 and 2019.

Disease	Azoxystrobin at mid-tillering	Azoxystrobin at mid boot	Azoxystrobin at early heading	Inpyrfluxam at mid tillering	Inpyrfluxam at mid boot	Inpyrfluxam at early heading
Stem rot	9 (9)	23 (4)	28 (13)	0 (2)	1.5 (2)	4 (4)
Aggregate sheath spot	21 (8)	76 (4)	57 (13)	35 (2)	82 (2)	70 (3)

Article by Luis Espino, UCCE Rice Farm Advisor, laespino@ucanr.edu

Think about your potassium fertilizer needs

Potassium (K) is an essential nutrient for rice. It is important to have good K fertility not only for optimizing yields but also K helps reduce the severity of some common plant diseases that we see (e.g. aggregate sheath spot and stem rot). Rice takes up about the same amount of K as N during the growing season (about 150 lb K/ac in a 90 cwt yielding field). However, when we apply fertilizer we usually apply less K than N because the soil supplies much of the K needs.

At harvest, about 20% of the K is in the grain and 80% in the straw (grain is 0.29% K and straw 1.4% K). For example, in a field where the yield is 90 cwt, there is about 26 lb K/ac in the grain and 126 lb K/ac in the straw. Thus, if you are only removing the grain, 26 lb K/ac (31 lb K_2O /ac) needs to be applied to maintain the soil K balance.

I saw a lot of straw bailing last fall and this may continue in the future if there is a viable and economic market for rice straw. For every ton of straw removed, about 30 lb K/ac (36 lb K_2O /ac) is removed with it (straw contains about 1.4% K). Therefore, if you are removing straw you need to think more carefully about replacing the K that was removed. In most bailing operations, about 40-80% of the straw is removed from the field. For modern, high yielding varieties, the amount of straw in a field is roughly equal to the amount of grain harvested from the field. Therefore, in a field that yielded 90 cwt, there is 4.5 tons of rice straw. If this K is not replaced, the soil K reserves will become depleted and K deficiency symptoms will begin to appear with time. How long it takes will depend on the soil and how much straw is being removed.

Fig. 2. Symptoms of K deficiency.

In the Sacramento Valley, the soils that are most susceptible to K deficiencies are those with a low clay content and those on the eastern side of the Sacramento Valley (not just the red soils). We suggest testing your soil for K. When the soil exchangeable K is less than 120 ppm [ammonium acetate (NH_4OAc) extractable K] you need to think about adding K fertilizer. Another soil test is the percent base saturation of K. If the K saturation is 1.6% or less then you should consider adding K fertilizer.

When testing the soil for K, be mindful of how you sample. In a study we did of 55 rice fields, we found that in 70% of the fields, the bottom check had higher K levels than the top check. This may be for a couple of reasons. First, it may be a legacy of field leveling. When leveling a field, it is likely that top soil (higher in K) is moved from the upper part (top check) of the field to the lower part (bottom check). A second reason is that K is relatively mobile in water and irrigation water can push K from the top checks to the lower checks in the field.

Finally, some common K deficiency symptoms include (1) yellow/brown leaf margins, (2) dark brown spots on leaf surface, and (3) leaf bronzing (fig. 2).

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Weeds to Watch Out For in 2020

Marshweed

Marshweed (*Limnophila x Ludoviciana* Thieret) (figs. 3 and 4) is a perennial aquatic weed first officially identified in California rice fields in 1977 in Yuba County. The later recorded sightings of it (12 in total) are all in Butte County, from 1998 through 2013. The only other place it has been found in the US is in Louisiana, also in or around rice fields. It is thought to be a hybrid of two common aquarium plants.

Last season, in 2019, there were two reports from growers that had found this plant in their fields, one in Glenn County, and one in Sutter County. Although yields did not decrease, there was slow dry-down of the field. We hypothesize that this may be due partially to the nature of this particular weed, which forms a “mat” over the soil (figs. 5 and 6). There were also higher than normal moisture levels reported in the harvester, most likely due to parts of the weed itself being pulled into the combine.

Dr. Albert Fischer did some preliminary work on control in 2011-2013, all under greenhouse conditions, at two timings: young plants (approximately 1 inch tall), and established plants that had not yet emerged from the water. They tested field rates of all of the registered granular products that were available at the time: Londax, Sandea, Bolero, League MVP, Shark H2O, Granite GR, and Butte.

On the young, newly emerged plants, Bolero and League MVP showed 100% control by about 4 days after application. Butte appeared to provide full control by 18 days after application. Londax and Sandea are slow to act, but by 18 days after application they were mostly controlling Limnophila. On the established plants, no herbicides controlled Limnophila, but Londax and League MVP prevented it from emerging from the water (30 days after application), and prevented it from flowering.

Figure 3. Marshweed (*Limnophila x Ludoviciana*) before flowering (Photo: Shaun Winterton, Aquarium and Pond Plants of the World, Edition 3, USDA APHIS PPQ, Bugwood.org).

Figure 5. Marshweed (*Limnophila x Ludoviciana*) at harvest in a rice field. Note the dried flowers, which indicate that these plants likely went to seed (Photo: Luis Espino).

Figure 4. Marshweed (*Limnophila x Ludoviciana*) at flowering (Photo: Shaun Winterton, Aquarium and Pond Plants of the World, Edition 3, USDA APHIS PPQ, Bugwood.org).

Figure 6. Marshweed (*Limnophila x Ludoviciana*) at harvest in a rice field (Photo: Luis Espino).

Alligatorweed (originally published in Rice Farming Magazine, March 2020)

Alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.) (fig. 7), a perennial aquatic weed, was spotted in California rice-growing counties along the edge of the Feather River in 2019. Eleven different locations/populations were found in Butte County, and one location was identified in Sutter County. Exact locations for all of the populations can be found on Calflora.org. Prior to 2019, the furthest north that alligatorweed had been found was in Sacramento County, along the Sacramento River (2017). There have been populations in southern California for a number of years: in Los Angeles County since the 1940's and in Tulare and Kings' counties since the 1960's.

Alligatorweed is commonly found throughout the southern United States, including in rice fields. It was introduced to the southern US from South America in the early 1900's, presumably in a boat ballast. It is classified as a noxious weed in both California and Texas, but is not federally listed as a noxious weed. There are two currently registered California rice herbicides that can control it: Regiment® (bispyribac-sodium) and Grandstand® (triclopyr). It is a labeled weed for both herbicides, and rates and timings for its control can be found on their respective labels.

Alligatorweed grows well in shallow water, in muddy areas. It can grow up to 3 feet tall and has hollow stems. The leaves are opposite on the stem, and the flowers are white and clover-like in appearance. It flowers during the summer (May-October). In the US, it does not reproduce by seed, but is spread vegetatively. This means that pieces of the plant have to float along waterways in order to spread. Boats are a likely mechanism of movement from waterway to waterway.

Since it is an aquatic weed, already known to infest rice fields in other parts of the US, there is potential for it to move into rice fields in California. As of the writing of this article, there have not been any plants found in California rice fields. Because the potential is there, however, it is a good idea to keep a lookout and be vigilant.

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Figure 7. Alligatorweed (*Alternanthera philoxeroides*) at flowering (Photo: Mary Keim).

Herbicide Trial in Delta Drill-Seeded Rice

Weeds are important pests of California rice systems, and weed management can account for roughly 17 percent of total operating costs, according to a UC cost of production study. Integrated weed management uses cultural and chemical practices and considers the following:

- Prevention (e.g. using certified seed, equipment sanitation, maintaining roads and levees)
- Cultural practices (e.g. land leveling, crop rotation, tillage, winter flooding, drill-seeding)
- Fertilizer placement and management
- Water management
- Monitoring
- Herbicides

Herbicides are important tools; however, resistance can occur when products are not rotated, or when diverse chemistries are not available.

In 2019, in cooperation with Corteva Agriscience, I conducted a trial to evaluate the efficacy of a new herbicide product called Loyant (florpyrauxifen-benzyl). Loyant is registered in rice growing states in the southern US but would be a new chemistry in California. Corteva Agriscience anticipates California rice registration in 2020, with the product being available for use in 2021. Previous trials have shown that Loyant provides good control of broadleaf weeds (e.g. ducksalad, redstems), smallflower umbrella sedge, and ricefield bulrush. It has some activity on *Echinochloa* species (e.g. barnyardgrass, watergrass). More data was needed, however, in drill-seeded systems. The objective of the trial was to assess the efficacy and crop tolerance of Loyant for weed control in drill-seeded rice in California.

The trial took place in the Delta region on a Kingile muck soil. This soil classification is characterized as having upwards of 40 percent organic matter in the top foot of soil. On high organic matter soils in the Delta, the typical practice is drill-seeding. Water-seeding, which is the typical practice in the Sacramento Valley, is not successful in the Delta because the soil particles can float and move too easily, causing seed to get buried too deeply and germinate poorly.

For a full report on this trial with methods and crop injury data tables, please see my website. Treatments are described in Table 3 below. We observed slight to noticeable leaf curling in the Loyant treatments at 14 days after treatment (DAT), but this had disappeared by 21 DAT. We observed no stunting or stand reduction with any of the treatments; nor did we observe any differences in heading. All treatments had similar weed control with the exception of the Prowl-only treatment, which had statistically higher weed counts. Loyant does not control sprangletop, so sprangletop was the weed most commonly observed. We found no differences in yield or seed moisture at harvest (Table 4 below), and we observed no lodging. Yield averaged 8965 pounds per acre across treatments, and seed moisture averaged 13.7 percent.

In summary, the purpose of this trial was to learn the efficacy and crop tolerance of Loyant (florpyrauxifen-benzyl) for weed control in drill-seeded rice. We observed slight leaf rolling with the Loyant treatments a couple weeks after treatment, but those symptoms were gone by the third week after treatment. We observed Loyant to have good activity on the *Echinochloa* species but not on sprangletop, which was expected based on previous company trials. We observed Loyant treatments to have similarly low weed counts compared to the grower standard practice, and no significant differences in yield among the treatments. Tank mixes will be needed to manage sprangletop. The results indicate that Loyant could be used in drill-seeded rice herbicide programs, providing a different chemistry for herbicide resistance management.

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Table 3. Herbicide treatments in the 2019 drill-seeded rice trial.

Materials	Rate (unit of product/acre)	Herbicide Program denoted as
Loyant, Prowl H2O, MSO	1.37 pints, 5.5 pints, 0.5 pints	Loyant-high + Prowl
Loyant, Prowl H2O, MSO	1.024 pints, 5.5 pints, 0.5 pints	Loyant-low + Prowl
Loyant, MSO	1.37 pints, 0.5 pints	Loyant-high
Regiment, Sandea, Prowl H2O, Super Wham, MSO, UAN-32	0.2 ounces, 0.8 ounces, 5.5 pints, 6 quarts, 16 fluid ounces, 2 gallons/100 gal	Grower standard
Prowl H2O	5.5 pints	Prowl
Regiment, Sandea, Prowl H2O, Loyant, MSO, UAN-32	0.2 ounces, 0.8 ounces, 5.5 pints, 1.37 pints, 16 fluid ounces, 2 gallons/100 gal	Grower substitute

Table 4. Harvest results for the 2019 drill-seeded herbicide trial. Results are the average across four replicated blocks. Yield was adjusted to 14 percent moisture.

Herbicide Program (Treatment)	Seed Moisture (%)	Yield (lbs/ac)
Loyant-high + Prowl	13.8	9251
Loyant-low + Prowl	13.8	9122
Loyant-high	13.8	8632
Grower standard	14.0	8896
Prowl	13.8	8896
Grower substitute	13.1	8994
Average	13.7	8965
Coefficient of Variation (%)	5	3
Significance of treatment effect (P value)	0.0566	0.5748