HEALTHY FOOD SYSTEMS | HEALTHY ENVIRONMENTS | HEALTHY COMMUNITIES | HEALTHY CALIFORNIANS

Rice Leaf

January 2022

UC CE University of California Agriculture and Natural Resources | Cooperative Extension Butte County

Contents January 2022

Summary of 2021 Rice Variety Trials

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.

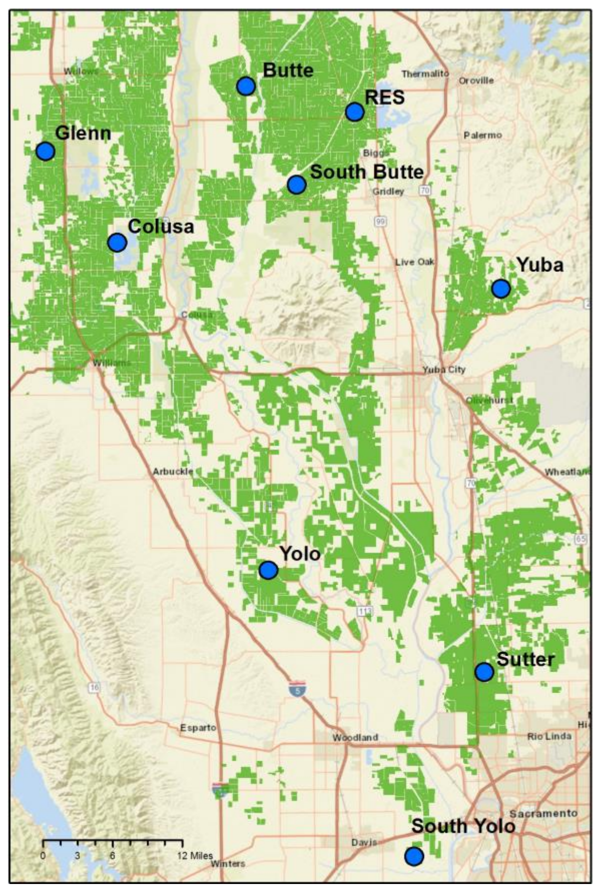

Fig. 1. Location of the UCCE and RES variety trials (RES=Rice Experiment Station)

The trials were conducted at the RES, seven farm locations across the Sacramento Valley, and one location in the San Joaquin Delta (not on the map) representing the main production areas of California. The South Yolo location was not harvested due to midge problems. Plots in the Sacramento Valley trials were 200 ft^2 and hand

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seeded while in the San Joaquin Delta trial plots were 150 ft^2 and drill seeded; seeding rate for all trials was 150 lbs/a. Grower cooperators treated the 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. Varieties are replicated four times. In this summary, only yields are presented. All other parameters are included in the complete report, which will be available on our website at the end of February (http://rice.ucanr.edu).

Article by Luis Espino, UCCE Rice Farm Advisor

Table 1. Yield (lbs/a) from variety trials conducted at eight locations across the Sacramento and San Joaquin Valleys and at the Rice Experiment Station (RES) in 2021.

Varieties	Colusa	Glenn	Butte	South Butte	Sutter	Yolo	Yuba*	San Joaquin	RES**
M-105	10,470	9,670	7,620	9,460	8,750	9,350	6,500	10,090	9,113
M-206	9,690	9,560	7,420	9,250	9,610	9,520	7,050	9,940	9,453
M-210	9,480	9,780	8,870	9,500	9,450	9,330	6,550	9,950	8,853
M-211	9,400	9,630	9,200	8,420	9,160	9,930	6,560	12,000	10,700
S-202	11,020	9,950	9,480	10,590	10,730	9,290	8,670	10,470	11,043
CH-202	9,110	7,910	4,090	7,850	10,060	8,840	5,290	8,590	8,957
CJ-201	10,250	9,670	8,330	8,850	9,350	9,570	7,090	11,540	10,337
L-207	10,200	10,350	9,030	10,430	10,360	10,120	9,260	10,260	10,070
L-208	10,770	11,080	10,980	10,370	10,920	10,310	7,800	10,700	10,820
CA-201	8,190	6,930	5,110	7,590	7,330	6,260	5,250	6,920	6,730

* Weed problems resulted in lower than expected yields
** Average of three trials

Tadpole Shrimp Management: Moving Beyond Pyrethroids

Currently, the most-used insecticides for managing tadpole shrimp are pyrethroids, primarily lambda-cyhalothrin. In most cases, efficacy is great and material cost is low. However, the reliance on one active ingredient for repeated applications in multiple years (or a single mode of action even *if* switching between active ingredients) is a key ingredient in the recipe for development of insecticide resistance. Movement of pyrethroids into waterways is also of high concern. While some other materials are available, they tend to be more expensive, so timing comes into play; a "wait-and-see" approach means shrimp will be larger and likely harder to manage. There is also the potential that novel materials might be effective for shrimp management. Biocontrol by mosquitofish could even play a role in shrimp management, perhaps in organic systems.

Through research funded by the CA Rice Research Board, we have been evaluating a number of insecticides, using different materials, different rates, and different timings. We have been testing treatments applied pre-flood, immediately post-flood or at a rescue treatment timing. We also tested if mosquitofish added at flooding could reduce shrimp populations and damage. All of this work has been at the Rice Experiment Station. Insecticide work was conducted in 11 ft^2 metal rings, while work with mosquitofish used 100 ft^2 squares.

Thus far, our results are promising. For our primary insecticide trial, we scooped out all of the shrimp at the end of the trial to measure the shrimp population. Our untreated rings had an average of over 50 shrimp per ring, so nearly 5 shrimp per square foot. We have done a great job fostering a good shrimp population in our field at the station! Virtually all of the insecticides we tested provided excellent control, basically completely killing the shrimp. Promisingly, this also included our reduced rates (below label) and late timings (8 days post-flood, medium-sized shrimp; you can definitely see them zooming at this point). Belay (clothianidian) and Dimilin 2L (diflubenzuron) have proven effective before and we found that even at reduced rates and applied "late", they were still very effective. Evergreen Pro 60-6 (pyrethrins+piperonyl butoxide/PBO) was also very effective and the addition of PBO could be useful if resistance is present. We tried an oil-based material again that is used for mosquito larvae control (CocoBear) with fairly unimpressive results this year. We had also tested Vantacor (chlorantraniliprole), which was very effective against tadpole shrimp at a variety of rates and at several timing, including a pre-flood application applied to soil. It should be noted that Evergreen Pro 60-6, CocoBear, and Vantacor are not currently registered for use in rice.

For the fish trial, we had a few small issues in several blocks, but the results were generally promising. We tested a range of fish densities (10/25/40 fish per 100 ft^2) and it appeared that all densities could reduce shrimp numbers to some degree, although their efficacy depends on shrimp pressure. This is not surprising though because of the fundamental difference in how biological control works compared to insecticides. There is also a limited window when the fish can eat the shrimp. At some point, the shrimp get large enough that the fish cannot get their little mouths around them. There was also a trend towards reduced damage when we looked at how much seedling roots had been chewed. We plan to follow up on this work to hopefully see if we get consistent results.

Finally, we are **still interested** in tracking insecticide resistance for tadpole shrimp. We would like to hear about management issues (likely with pyrethroids) if they are occurring. If we can, we would like to sample the fields (soil with eggs) to collect tadpole shrimp to be used in laboratory assays to get a better handle on insecticide resistance. Please contact Ian Grettenberger (imgrettenberger@ucdavis.edu) if you would be willing to help/are interested. We just need fields with shrimp, field locations, and permission to access!

Tadpole shrimp management, and addressing this pest using IPM principles, is something we need to stay on top of. We will continue to investigate novel chemistries and figure out how to "best use" currently available materials in a way that both limits costs and provides sufficient control. Hopefully, we can maintain the efficacy and registrations of current products and expand our management options and tools moving forward.

To learn more about tadpole shrimp and their biology, check out this awesome video by PBS's Deep Look series about tadpole shrimp. Use this link/address (https://youtu.be/T2xnXaX7r3g) or scan the QR code below with your phone (open camera and point at the code).

Article by Ian Grettenberger, UCCE Entomology Specialist, imgrettenberger@ucdavis.edu

Our insecticide trial for tadpole shrimp using metal rings.

Metal ring plots in the insecticide trial with a ring with effective tadpole shrimp control on the left, and an untreated control on the right. Note the better stand and clear water on the left.

Our square metal plots used for our tadpole shrimp biological control trial. Note the crystal clear plot at front left; this plot had a high density of fish, which ate all of the shrimp in this plot. Other plots are murky and stirred up from all of the shrimp.

Watergrass Herbicide Screening: 2021 Results

In 2020, we conducted a small screening with a set of 10 watergrass samples (collected in 2018) from across the valley, trying to see if we could get an idea of what herbicides controlled the different species/biotypes. The results from those 10 samples indicated that Clincher, propanil, and Regiment, as well as Cerano, had the best control overall, although there was variation between the different samples. The samples were all suspected to be the new biotype/species.

In 2021, we conducted a larger survey, with grower and PCA-submitted samples from across the Sacramento Valley (Figure 1), as well as samples we collected from UC and Rice Experiment Station fields. We had a total of 64 samples, which were representative of all of the watergrass species/biotypes: late watergrass, junglerice, barnyardgrass, and the new biotype/species.

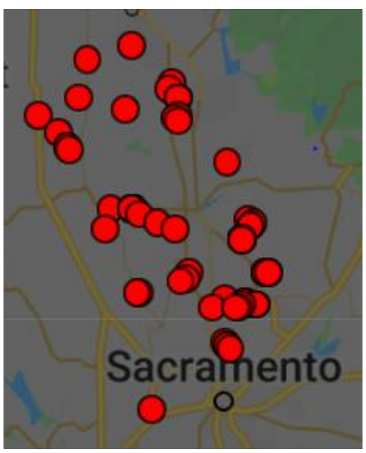

Figure 1. Samples were collected from across the rice-growing region, in all major rice-growing counties except for Sacramento.

I did a preliminary identification of the samples (Table 1), but better identification of the samples is currently in progress with the UC Davis Herbarium. From the preliminary identification, the new biotype/species were 34.4% of the samples, junglerice were 3.1% of the samples, barnyardgrass were 48.4% samples, and late watergrass were 14.1% of the samples. Junglerice, although not a current rice field weed, is found around the edges of rice fields, so it was included in the analysis. A representative photo of the panicles of the three major types is below (Figure 2).

Figure 2. Photo of panicles from the three common California rice *Echinochloa* species. From left to right: unknown species/biotype, barnyardgrass, and late watergrass.

Methods:

The 64 samples collected in 2021 were the same samples used in the phenotypic analysis of weedy rice. The herbicides used for screening were: clomazone (Cerano®), thiobencarb (Bolero®), cyhalofop (Clincher®), benzobicyclon + halosulfuron (Butte®), penoxsulam (Granite GR®), bispyribac-sodium (Regiment®), and propanil (Stam® or SuperWham®). Rates were the recommended label rate (Table 2) with at least 4 replications per herbicide-sample combination.

Screenings took place at the Rice Experiment Station greenhouse in Biggs, CA, starting in the summer of 2021. The foliar applications and granular applications were conducted at different timings, and each was replicated twice in time. There were 3 replications of each treatment per sample. All formulations were tested at the 1.5-2 leaf stage of the watergrass. Dormancy was broken for the watergrass by wet-chilling in the fridge for approximately two weeks before planting. Pots were seeded and then thinned down to 5 plants per pot. All liquid formulations (Clincher®, SuperWham®, and Regiment®) were applied with the label-recommended surfactant (crop oil, crop oil, and Dyneamic®).

Applications for into the water herbicides were made onto the water surface of bins that were flooded to 4" above the soil surface of the pots (where the watergrass was planted). All herbicide treatments were applied with a cabinet track sprayer with an 8001-EVS nozzle delivering 40 gallons of spray solution per acre (at a pressure of approximately 20 psi). At 7 days after treatment, plants were evaluated for visual percent control (in comparison to an untreated control). At 14 days after treatment, the number of living plants per pot was counted, and fresh biomass was measured (per pot) by cutting plants at the soil surface and taking the weight (per pot). Dry biomass was measured after drying the fresh weight samples down to a constant weight.

Results:

On average, control of samples with granular herbicides was low (Figure 3). Junglerice, which is not a rice weed, but rather a weed that borders rice fields, was well controlled with Bolero® and Cerano®. It was not quite as well controlled with Butte® or Granite GR®. It was well-controlled by Clincher®, Propanil, and Regiment® as well (Figure 4). The two susceptible late watergrass samples were mostly well-controlled by Bolero® and Cerano® (Figure 3). They were not quite as well controlled with Butte® or Granite GR®. They were well-controlled by Clincher®, propanil, and Regiment® as well (Figure 4).

For the unknown samples, on average, control was poor with Bolero®, Butte®, and Granite GR®, regardless of species. Control with Cerano® was similar to control of the susceptible samples (Figure 3). We saw good control of all of the resistant samples with Clincher®, except for late watergrass. Propanil showed good control of all species as well. Regiment® had poor control of all of the species, except for junglerice (Figure 4).

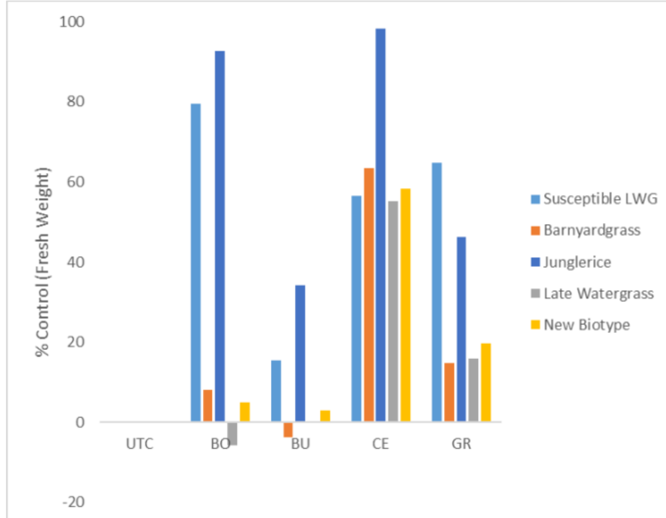

Figure 3. Average percent control compared to untreated control by fresh biomass at 14 Days After Treatment of 2 known susceptible late watergrass populations (Susceptible 1 and Susceptible 2), and 64 unknown watergrass populations, separated by species (UTC = Untreated Control, BO = Bolero, BU = Butte, CE = Cerano, GR = Granite GR)

Conclusion:

To all growers and PCA's that submitted samples, we will be sending individual screening results, as there are differences between the samples in terms of resistance to different herbicides.

For growers, the implications of this preliminary screening are that control of this new biotype/species will need to be prioritized early in the season. Possible treatments (keep in mind that these have not been field-tested and could cause phytotoxicity) could be: a stale seedbed using a non-selective herbicide; pre-plant Abolish® (thiobencarb) followed by Cerano® or Butte® or Granite GR®; Cerano® followed by Butte® or Bolero® or Granite GR®; or Butte® followed by Granite GR® or Bolero®. There is still a strong likelihood that a follow-up application may still be required later in the season, even with these early-season applications.

Article by Whitney Brim-DeForest, UCCE Rice Farm Advisor.

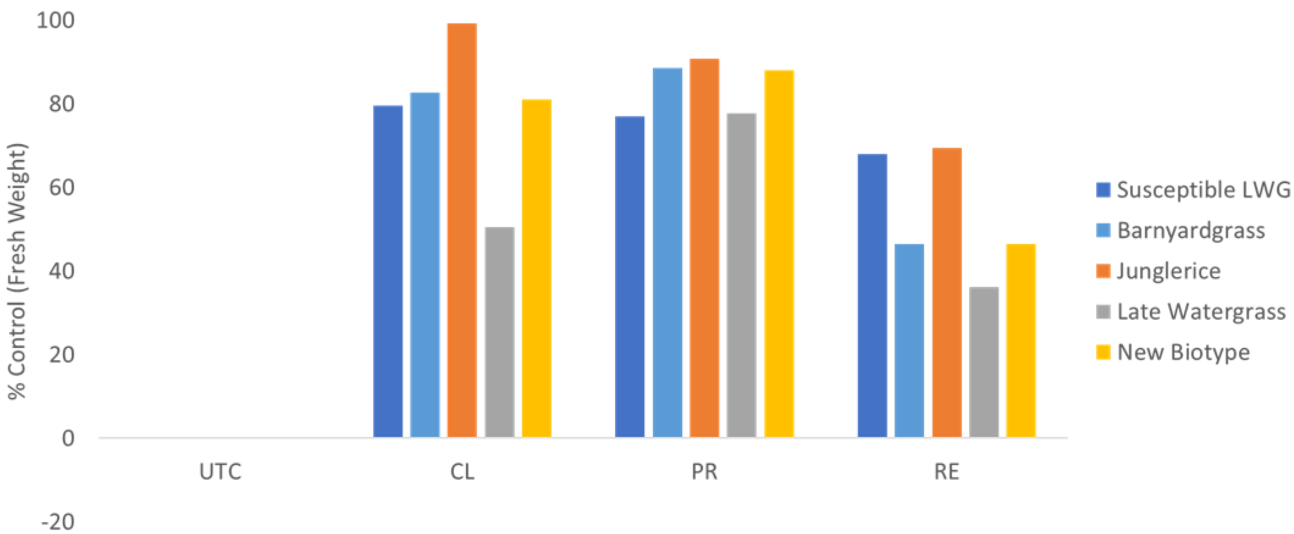

Figure 4. Average percent control compared to untreated control by fresh biomass at 14 Days After Treatment of 2 known susceptible late watergrass populations (Susceptible 1 and Susceptible 2), and 64 unknown watergrass populations, separated by species (UTC = Untreated Control, CL = Clincher, PR = Propanil, RE = Regiment)

Table 1. Watergrass (*Echinochloa* spp.) samples were collected across the rice-growing region in 2020. The samples were sorted by the seed description (preliminary description) and tentatively identified to species/biotype. Note the number of samples of each type, as well as the percentage of the overall samples.

Description	Tentative Identification	No. of Samples	Percentage (%)
Small seeds, long awns	New biotype	22	34.4
Extra small seeds, no awns	Junglerice	2	3.1
Small seeds, variable awns	Barnyardgrass	31	48.4
Large seeds no awns	Late watergrass	9	14.1

Table 2. Herbicides and rates utilized for the 2021 watergrass screening. Rates are given in product per acre.

Trade Name	Active Ingredient	Rate
Cerano®	Clomazone	12 lb a^{-1}
Bolero®	Thiobencarb	23.3 lb a^{-1}
Butte®	Benzobicyclon + Halosulfuron	7.5 lb a^{-1}
Granite GR®	Penoxsulam	15 lb a^{-1}
Clincher®	Cyhalofop	15 fl oz a^{-1}
Regiment®	Bispyribac-sodium	0.57 oz a^{-1}
SuperWham®	Propanil	6 qt a^{-1}

Herbicide Trial in Delta Drill Seeded Rice

From 2019-2021, we conducted trials to evaluate the efficacy of a new herbicide product called Loyant (florpyrauxifen-benzyl; group 4 herbicide; Corteva Agriscience) in Delta drill-seeded rice. Loyant is registered in rice growing states in the southern US but would be a new chemistry in California. Previous company trials have indicated that Loyant provides good control of broadleaf weeds (e.g. ducksalad, redstems), smallflower umbrella sedge, and ricefield bulrush. Results from 2019 and 2020 Delta trials indicate that Loyant has efficacy on grass weeds in the drill-seeded system, like watergrass and barnyardgrass (*Echinochloa* spp.). The objective of the 2021 trial was to assess the efficacy of Loyant on yellow nutsedge (*Cyperus esculentus*) (Figure 1).

Please see the full report (https://ucanr.edu/sites/deltacrops/Rice/) for trial methods, including treatment list and rates, and complete results with discussion. In 2021, we observed minor crop injury with all treatments in the form of leaf tip burning, but symptoms were no longer visible two weeks after treatment. No other injury symptoms were observed. In terms of weed control, the best treatment for yellow nutsedge in this trial was the grower standard program. Several Loyant treatments performed statistically similar to the grower standard herbicide program and better than the Prowl ("control") treatment (Table 1). Loyant alone performed statistically worse than the grower standard program in this trial. While Loyant is registered for yellow nutsedge in other states, lack of moisture can impact efficacy. The delay in establishing the permanent flood may have affected its efficacy in this trial. At 64 days after treatment (DAT), we observed that *Echinochloa* grasses had grown in the Prowl treatment, but they were controlled with the other treatments. The observations agree with the 2019 and 2020 trial results, where Loyant and Loyant tank mixes showed good efficacy on *Echinochloa* spp.

We also had a non-replicated demonstration site (on a different farm) where we evaluated post-flood applications of Loyant alone and in tank mixes. Treatments were applied in late-June, when grasses were heading, with the purpose of evaluating efficacy on grasses that had escaped the pre-flood grower standard program. No crop injury was observed with any treatments. Weed control was compared to a non-treated area outside of the demonstration area. All treatments had efficacy on grasses, but the Loyant/Clincher treatment appeared to work best under these circumstances. From this demonstration, we observed that post-flood treatments of Loyant alone and in tank mixes suppressed grasses that had escaped the grower standard pre-flood treatment.

Conclusions:

The purpose of the Delta trials was to learn the crop tolerance and weed control efficacy of Loyant (florpyrauxifen-benzyl) in drill-seeded rice, with the specific objective in 2021 to evaluate efficacy on yellow nutsedge. The best treatment for yellow nutsedge control in this trial was the grower standard program. Loyant, alone, was not efficacious on yellow nutsedge, but performed well in tank mixes with other products. Three years of results trialing Loyant in the Delta drill-seeded system indicate that it could be used in herbicide programs, providing a different chemistry for herbicide resistance management.

Article by Michelle Leinfelder-Miles, UCCE Farm Advisor

Figure 1. The most prevalent weeds in the 2019 and 2020 trials were A) watergrass and barnyard grass (*Echinochloa* spp.) and B) sprangletop (*Leptochloa fusca*). The most prevalent weed in the 2021 trial was C) yellow nutsedge (*Cyperus esculentus*).

Table 1. Percent weed control, expressed as percent of the plot area, was estimated on 7-day intervals from 14 days after treatment (DAT) to 35 DAT. An untreated area of the field had approximately 1-4 sedges per square foot.

Herbicide Program (Treatment)	Weed Control (%)			
	14 DAT	21 DAT	28 DAT	35 DAT
Loyant	53 bc	34 bcd	34 b	34 bc
Loyant/Clincher	46 c	27 cd	13 bc	19 c
Loyant/Granite	84 ab	79 a	76 a	71 a
Loyant/RebelEX	80 abc	71 ab	68 a	66 ab
Grower standard	97 a	97 a	98 a	91 a
Prowl/control	0 d	0 d	0 c	0 c
Loyant/SuperWham	66 abc	58 abc	68 a	66 ab
Average	61	52	51	50
Coefficient of Variation (%)	10	13	13	13
Significance of treatment effect (P value)	<0.0001	<0.0001	<0.0001	<0.0001

Upcoming Meetings

IPM in Rice Workgroup Meeting: Crop Rotation Calculator

February 16, 2022

8:30AM	Registration and Sign-in
9:00AM	IPM in Rice Workgroup Overview (Whitney Brim-DeForest)
9:15AM	Outcomes from July Meeting: Crop Rotation Feasibility (Sara Rosenberg)
9:30AM	Crop Rotation Calculator Demonstration (Sara Rosenberg)
10:00AM	Feedback on Calculator Breakout Session (Facilitated by Sara Rosenberg and Whitney Brim-DeForest)
11:00AM	Meeting Adjourn

****** 2 CCA CE credits granted (Sustainability) ******

Location: UCCE Sutter-Yuba Conference Room

142A Garden Hwy

Yuba City, CA 95991

This project was funded in part by the USDA National Institute of Food and Agriculture, through the Western Integrated Pest Management Center

USDA United States Department of Agriculture National Institute of Food and Agriculture

Western IPM Center

2022 RICE GROWER MEETINGS

NEW DATES:

Richvale: Monday, **March 14**, 8:30am, Evangelical Church, 5219 Church St., Richvale
Willows: Monday, **March 14**, 1:00pm, Glenn County Office of Education, 311 South Villa Avenue, Willows
Colusa: Tuesday, **March 15**, 8:30 am, Community Center, Colusa County Fairgrounds, 10th Street (Hwy 20), Colusa
Yuba City: Tuesday, **March 15**, 1:00 pm, UCCE Office, 142 Garden Highway, Yuba City
Woodland: Wednesday, **March 16**, 8:30 am, Norton Hall, 70 Cottonwood St, Woodland
Virtual option: Thursday, **March 17**, 8:30 am (**registration link on our website: rice.ucanr.edu**)

TIME: Doors open at 8:30 am and meetings start at 9:00 am at Richvale, Colusa, and Woodland.
Doors open at 1:00 pm and meetings start at 1:30 pm at Glenn and Yuba City.
Check in for virtual meeting at 8:30, meeting starts at 9:00.

Program

8:30 am	(1:00 pm)	Doors open, sign-in, coffee
9:00 am	(1:30 pm)	Call meeting to order
		Agricultural Commissioner Updates
9:15 am	(1:45 pm)	Rice Research Board Introductions and Nominations – Dana Dickey, Rice Research Board
9:25 am	(1:55 pm)	Introduction of New Rice Experiment Station Director and Roxy Overview – Dustin Harrell, RES director, and Kent McKenzie, Albaugh Consultant
9:35 am	(2:05 pm)	Roxy Rice Production System Research Update – Kassim Al-Khatib, UC Davis
9:50 am	(2:20 pm)	Weedy Rice Research Update – Whitney Brim-DeForest, UCCE
10:05 am	(2:35 pm)	Invertebrate Research Update – Ian Grettenberger, UC Davis
10:20 am	(2:50 pm)	Disease Management Research Update – Luis Espino, UCCE
10:35 am	(3:05 pm)	Fertility Research Update – Bruce Linquist, UC Davis
10:50 am	(3:20 pm)	New Herbicides in Weed Management Research Update – Kassim Al-Khatib, UC Davis
11:05 am	(3:35 pm)	Variety Update and Yield Contest – Bruce Linquist, UC Davis
11:20 am	(3:50 pm)	— ADJOURN —

******Applied for DPR and CCA CE credits******