

A photograph of a rice field. In the foreground, a single, taller weed with a large, feathery seed head is in focus, leaning slightly to the left. The rest of the field is filled with green rice plants, some of which are slightly out of focus. The background shows a clear blue sky and a distant horizon line.

# **Weedy Rice Workshop**

## **August 1, 2019**

**University of California  
Cooperative Extension**

# Acknowledgements

- California Rice Commission
- California Rice Research Board
- California Crop Improvement Association
- Rice Experiment Station
- County Ag Commissioners
- Growers and PCAs

# Contents

- What is weedy rice and why is it a problem?
- Historical background
- Current weedy rice distribution
- Field Identification
- Management

# What is weedy rice?

- Same genus and species as cultivated rice
  - It is the same plant; a “wild” type
- Red pericarp
- Weedy rice plant types vary, but usually taller, lighter green, more vigorous, and with more tillers than cultivated rice



# Why is it a problem?

- Shattering
  - Higher shattering than cultivated rice
- Dormancy
  - Seed can remain in the soil for several years without germinating



# Seed Shattering and Dormancy

Table 4. Plant characteristics at harvest of 19 red rice ecotypes and three rice cultivars, College Station, TX, 1993.

Ecotype/cultivar	Lodging index <sup>a</sup>	Shattering			Seeds/panicle	1,000-seed weight	Germination	Dormancy
		Index <sup>b</sup>	Time <sup>c</sup>	Seed moisture				
AR 1	1	5	13	22.8	123	20.0	5	93
AR 2	3	5	21	21.3	48	22.7	2	90
AR 3	1	5	15	25.4	126	23.9	8	91
AR 4	1	7	18	15.4	85	24.7	3	94
LA 1	1	5	12	26.1	91	23.0	0	97
LA 2	1	3	12	24.1	105	22.6	17	77
LA 3	1	7	— <sup>d</sup>	— <sup>e</sup>	79	19.5	0	97
LA 4	7	9	15	26.9	35	18.5	2	94
LA 5	1	9	11	30.2	72	24.4	3	94
MS 1	3	7	17	23.0	67	24.8	23	72
MS 2	3	3	12	23.7	125	19.3	2	91
MS 3	9	1	— <sup>d</sup>	— <sup>e</sup>	81	19.4	7	89
MS 4	1	9	13	29.4	88	17.3	2	95
MS 5	1	1	— <sup>d</sup>	— <sup>e</sup>	77	22.6	28	63
MS 6	1	9	13	28.1	67	22.9	23	74
TX 1	3	9	15	21.6	68	20.6	0	93
TX 2	9	1	— <sup>d</sup>	— <sup>e</sup>	59	21.8	5	87
TX 3	1	9	13	24.6	84	24.0	0	96
TX 4	9	9	17	25.5	41	22.2	3	93
Lemont	1	1	— <sup>d</sup>	— <sup>e</sup>	133	24.6	92	7
Mars	1	1	— <sup>d</sup>	— <sup>e</sup>	112	21.7	95	2
Maybelle	1	7 <sup>f</sup>	— <sup>d</sup>	— <sup>e</sup>	111	20.1	94	3
Tukey (0.05)	—	—	—	—	—	—	11	13

<sup>a</sup> 1, No lodging; 3, more than 50% plants with some tendency to lodging; 5, more than 50% plants moderately lodged; 7, more than 75% plants lodged; 9, all plants completely lodged.

<sup>b</sup> 1, very low (< 1%); 3, low (1–5%); 5, moderate (6–25%); 7, moderately high (26–50%); 9, high (> 50%).

# Why is it a problem?

- High shattering means rice is not being picked by harvesters. High dormancy means the seed bank can stay in the soil for long periods
- Result: lower yield and quality
- Reported yield reductions of 27-45% in southern US (up to 88%)

# Effect on Yield

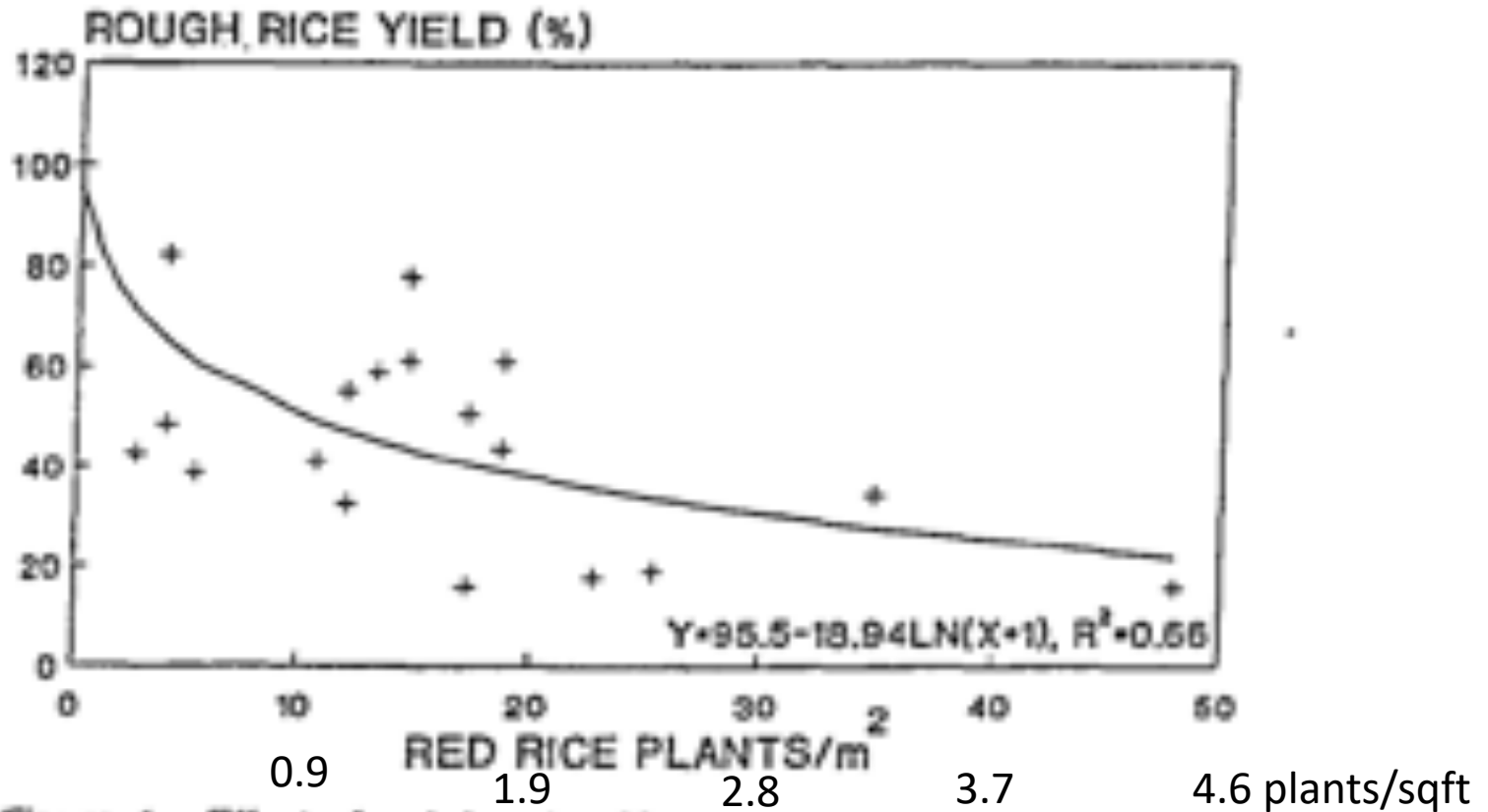


Figure 4. Effect of red rice densities on grain yields of rice *Oryzica 1* as percentage of the weed-free yield.

1993, Fischer, CIAT, Colombia



# Why is it a problem?

- Reduction in quality
  - Increased milling costs
    - Color sorters
  - Overmill rice to remove red bran, increases breakage

## GRADES, GRADE REQUIREMENTS, AND GRADE DESIGNATIONS

§868.210 Grades and grade requirements for the classes of Rough Rice. (See also §868.212.)

Grade	Maximum limits of ---						Color requirements (minimum)	
	Seeds and heat-damaged kernels			Red rice and damaged kernels (singly or combined) (Percent)	Chalky kernels			Other types (Percent)
	Total (singly or combined) (Number in 500 grams)	Heat-damaged kernels and objectionable seeds (singly or combined) (Number in 500 grams)	Heat-damaged kernels (Number in 500 grams)		In long grain rice (Percent)	In median or short grain rice (Percent)		
U.S.No. 1	4	3	1	0.5	1.0	2.0	1.0	Shall be white or creamy.
U.S.No. 2	7	5	2	1.5	2.0	4.0	2.0	May be slightly gray.
U.S.No. 3	10	8	5	2.5	4.0	6.0	3.0	May be light gray.
U.S.No. 4	27	22	15	4.0	6.0	8.0	5.0	May be gray or slightly rosy.
U.S.No. 5	37	32	25	6.0	10.0	10.0	10.0	May be dark gray or rosy.
U.S.No. 6	75	75	75	15.0 <sup>d</sup>	15.0	15.0	10.0	May be dark gray or rosy.

U.S. Sample grade---

# Effect on Quality

Table 1. Effect of CaO<sub>2</sub>, molinate, and R-33865 applications on rice and red rice, 1982 and 1983<sup>a</sup>.

Treatments			Culms		Total rice grain yield	Red rice grains in rough rice	White rice grain yield <sup>b</sup>	Head rice yield
CaO <sub>2</sub>	Molinate	R-33865	Rice	Red rice				
(% w/w)	(kg/ha)	(% v/w)	— (no./m <sup>2</sup> ) —		(kg/ha)	(%)	(kg/ha)	(%)
40	0	0.0	261 a	120 c	5200 ab	25 cde	4130 abc	63 bc
40	0	0.5	173 b	132 bc	3950 bc	49 abcd	2190 cd	60 bcd
40	0	1.0	31 cd	146 bc	2810 c	61 abc	1010 d	52 e
40	6.7	0.0	211 b	7 d	5690 a	4 e	5480 a	64 ab
40	6.7	0.5	184 b	7 d	6030 a	4 e	5850 a	63 ab
40	6.7	1.0	64 c	16 d	3900 bc	7 e	4480 ab	60 bcd
0	0	0.0	10 d	185 abc	3160 c	74 a	880 d	55 de
0	0	0.5	14 cd	226 a	2720 c	67 a	880 d	52 e
0	0	1.0	51 cd	192 ab	4020 bc	65 ab	1740 d	56 cde
0	6.7	0.0	20 cd	6 d	2680 c	9 e	2410 cd	63 ab
0	6.7	0.5	37 cd	2 d	2740 c	19 de	2370 cd	60 bcd
0	6.7	1.0	51 cd	3 d	3050 c	30 bcde	2640 bcd	68 a

<sup>a</sup>Values are for the triple-order interaction of CaO<sub>2</sub> by molinate by R-33865. In the same column, means followed by the same letters do not differ significantly at the 5% level according to Duncan's multiple range test.

<sup>b</sup>Calculated by subtracting the weight of red rice from the total rice grain yield.

1985, Diarra, Arkansas

# Historical Background

- 1917: first reference of weedy rice in CA
- 1930s: weedy rice present in seed
  - 31-42% of seed samples from CA contained red rice (3-57 seeds/lb)

UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION  
COLLEGE OF AGRICULTURE BERKELEY  
BERKELEY  
W. W. MACKIE, MANAGER  
THOMAS PERKINS HUNT, CHIEF OF STATION  
H. E. VAN NORDEN, VICE-DIRECTOR AND DEAN  
UNIVERSITY PLUM BRIDGE

## IMPROVING RICE SEED

By W. W. MACKIE

OCTOBER, 1917

Only the best and purest rice seed should be planted because such seed produces the best plants, the largest yields, and the earliest maturity. The planting of impure seed has spread many pests. The most injurious rice seed pests in California are water-grass, red rice, and rogue rices. Other weed seeds do not appear to be serious or they can be removed by proper re-cleaning of the seed.

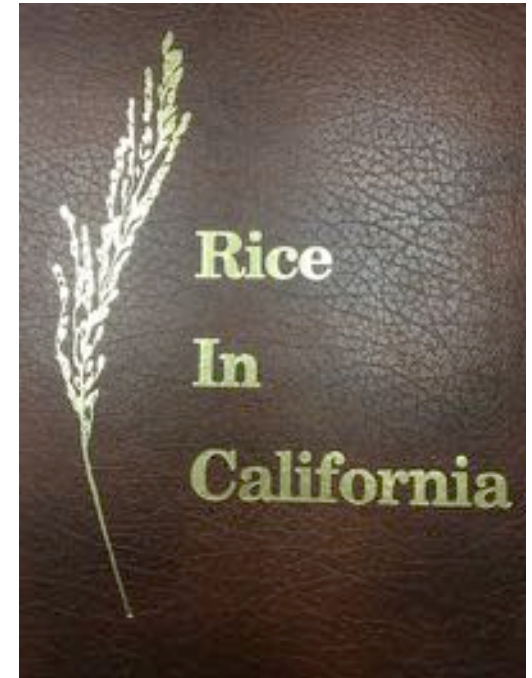
Water-grass is the most serious pest to the California rice farmer. In July when the rice fields are in flood, the water-grass may be detected by its more compact or lumpy habit of growth and the darker color of its leaves. The veins of the leaves are not all parallel as in rice, but contain cross veins. Water-grass matures earlier than rice and its large, heavy bearded heads can be readily distinguished. The mature seed is about the size of No. 6 shot and is covered with a smooth, glistening coat to which is attached a barbed beard. This barbed beard serves to attach the seed to grain sacks. Old or refilled rice sacks therefore should not be used for rice seed. Water-grass seed, being very heavy, cannot be completely cleaned out of the rice seed even by good re-cleaning machinery. Hence it is imperative, if clean seed is to be secured, that no water-grass seed should be harvested, even though the field must be hand pulled many times even to the day of harvest.

*Red rice* is a different species of rice from the commercial varieties. It can be detected by its habit of dense bunching due to profuse tillering. This plant is usually earlier, darker in color, shorter and more spreading than the varieties of rice grown commercially in California. The heads are bearded, dark in color and ripen irregularly. Many blasted or infertile florets are usual. As soon as the kernels become hard they begin to drop to the ground, where they remain uninjured by the water or winter rains until spring, when a large number volunteer at the time of rice planting. One red rice seed may produce several thousand seeds. When these appear in the milled rice they give the product a dirty, unattractive appearance which discounts the price. To test for red rice seed in threshed or rough rice, rub a

Digitized by Google

# Historical Background

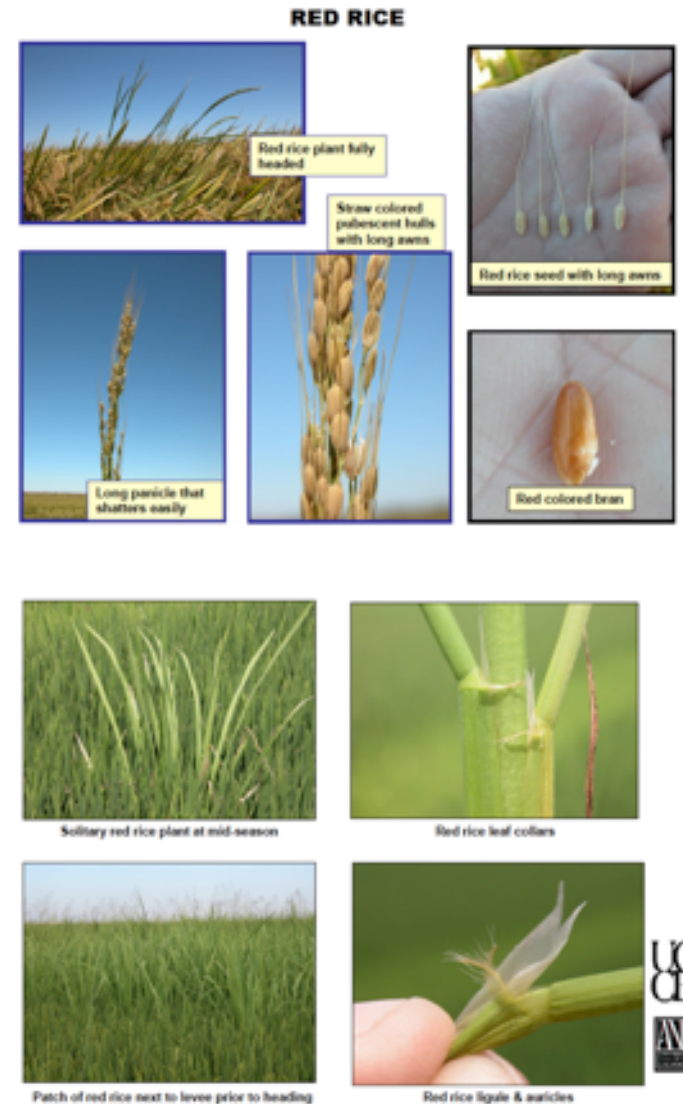
- 1950s: certified seed widely adopted
- 1950s-2000s: rare, but still present



SEAMAN (comment): There is no **red rice** problem in **California**. I have difficulty in finding a specimen of **red rice** for my weed collection. From 1920 to 1940, there was a tremendous build-up of the percentage of seed lots from all over the state that were severely contaminated with **red rice**. Now, there is no problem. I attribute this to our continuous flooded **rice** culture and the use of molinate and other herbicides.

# Historical Background

- 2003 –Glenn County
- 2006 - six fiends in Glenn and Colusa counties
  - Only one weedy rice type identified
- 2007-2015: A few isolated finds, new types



# Current Situation and Distribution

- 2016: Several fields found infested in all counties, 5 different types
- 2018: Aprox 14,000 infested acres, 6 types
- 2019: certified seed use requirement



Type 1



Type 2



Type 3



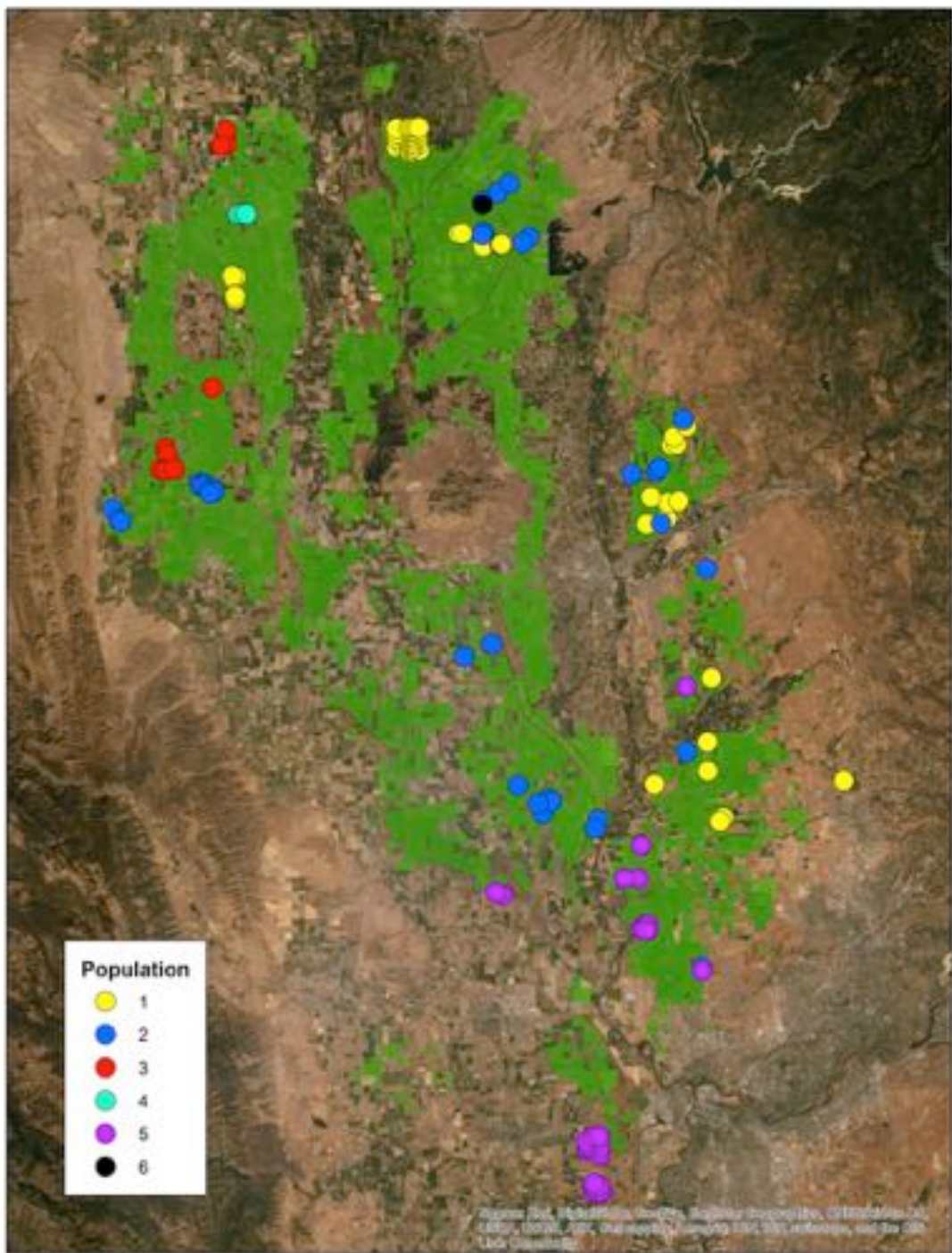
Type 4



Type 5



Type 6



Type	Acreage
1	6,341
2	4,093
3	791
4	161
5	2,553
6	148

County	Acreage
Butte	3,365
Colusa	795
Glenn	926
Placer	873
Sacramento	354
San Joaquin	659
Sutter	2,688
Yolo	1,836
Yuba	2,370
<b>Total</b>	<b>13,866</b>



# Field Identification

- Easily confused with watergrass, sprangletop





Photos from Timothy Blank, CCIA

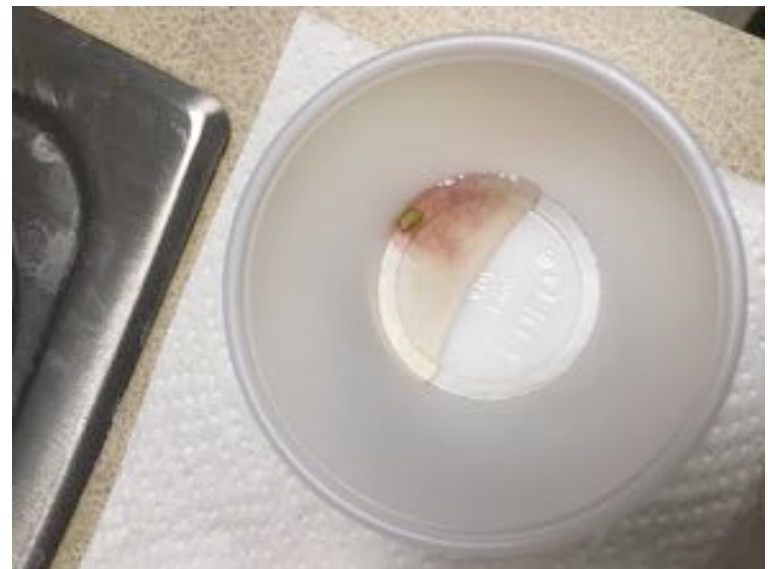
# Field Identification

- Leaves are rough (pubescent)
- Usually taller, lighter green, many tillers
- In patches, distributed with tillage, unless introduced with seed



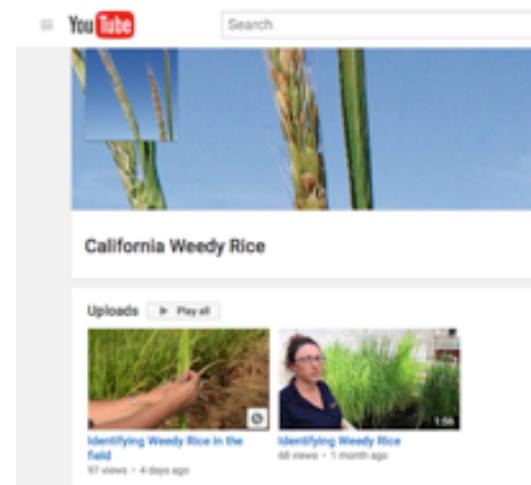
# Field Identification

- Easier to ID at heading
- Before maturity, kernels stain red when soaked in KOH (15 g/l)
- To confirm ID, plants need to be grown until heading



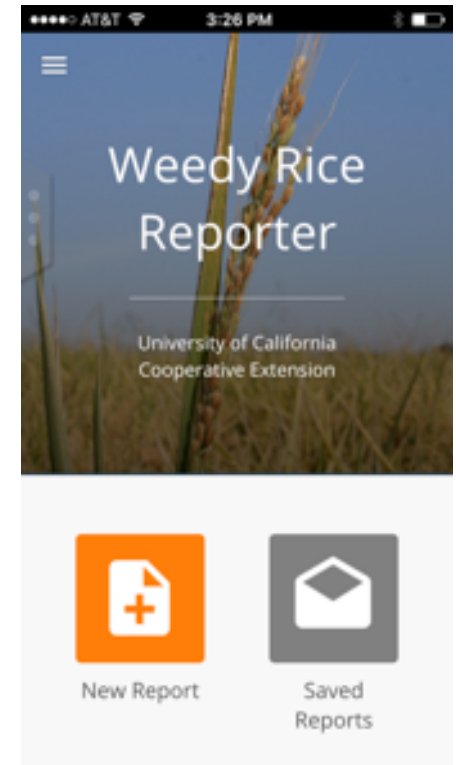
# Field Identification

- Easily confused
  - Off types
  - Specialty varieties
  - Elongated Upper Internode



# Field Identification

- Contact UCCE
  - Mobile App “Weedy Rice Reporter”
- Whole plant samples
- Do not take samples to Rice Experiment Station



# Management

- Fall/Winter
  - Do not disk field
  - Burn and flood
- Spring and season
  - Use certified seed
  - Stale seedbed
  - Fallow followed by flush and burndown
  - Hand rogue

