



WEEDY RICE IN CALIFORNIA

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Background: Worldwide

- Weedy rice is found all over the world
- Many populations are present in many locations
- Source of weedy rice (origins):
 - Import of weedy rice
 - De-domestication (rice going “feral”)
 - Hybridization between cultivated varieties and weedy/wild species



Background: California

- Weedy rice thought to be “not suited” to CA growing system:
 - Flooding
 - Strong seed certification program
 - Import restrictions and varieties bred specifically for CA
- Previously CA and Uruguay only rice-growing locations without weedy rice

Background: California

- Last survey of weedy red rice conducted in 2006
 - 4 sites/fields (in 2 counties)
- Updated in 2008 (locations not expanded)
- Between 2008 and 2015
 - Several suspected samples submitted to CA Rice Experiment Station and CE Advisors
- Currently (as of 2016):
 - Approximately 60 fields
 - Over 10,000 acres (2% of California rice acreage)

What happened?

- Poor definition of “weedy rice”
 - Many were defined as “colored bran” without checking for weedy characteristics
- Assumption that all weedy rices look the same
 - Awned, straw-hulled (original 2006 population)
- No coordinated survey efforts
- Pest Control Advisers and growers not aware of the problem
- Looks a lot like watergrass
 - Many growers have herbicide-resistant watergrass

Current Distribution

- Found in 8 counties:
 - Butte
 - Glenn
 - Colusa
 - Sutter
 - Yuba
 - San Joaquin
 - Placer
 - Yolo
- Present >60 fields
- Known acres affected:
10000+



Weedy Rice Facts

CA weedy rice populations were imported from the Southern US

FALSE

Genetic analysis of the 2006-2008 populations indicate that they are distinct from the Southern US populations

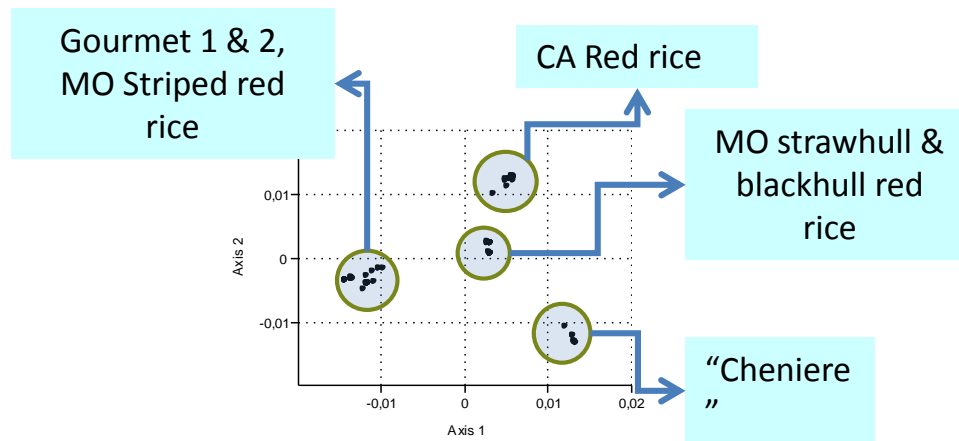


Figure 2. Correspondence analysis based on genetic distances (Dice)

*Source: Ortiz et al
2008*

Weedy Rice Facts

Weedy rice in CA is a hybrid between watergrass and rice

FALSE

Weedy rice in CA is the same species as domesticated rice (both are *Oryza sativa* L.)

Watergrass and rice CANNOT hybridize

Weedy Rice Facts

All weedy rice populations look the same

FALSE

No, there is high diversity and many populations look different

Weedy Characteristics

- **Biological:**

- Seed shattering
- Seed dormancy (ability to remain viable in the soil)
- Vigorous growth
- Early maturing

- **Appearance:**

- **Red pericarp (NOT ALWAYS)**
- Awned & awnless types
- Black, bronze & straw hull types
- Pubescent & glabrous hull types
- ***Taller than domesticated rice***
- ***Lighter leaf color***
- ***Pubescent (rough) leaves***



Source: Siriwardana 2014, Photo: Timothy Blank, CCIA

Why is it important to try to control weedy rice?

- Same species as rice!
 - Herbicides ineffective
 - Requires cultural management
 - Fallow, stale seedbed
 - Hand-roguing
 - **INCREASES WEED MANAGEMENT COSTS**
- Can impact quality
 - In white rice, extra milling required
 - In brown rice, has to be sorted out
- Can affect yields
 - Shattering!
 - If heavily infested, can reduce yields by 60% (Southern US)



Field in Arkansas. Image from:

<https://www.bio.umass.edu/biology/sites/imladris.bio.umass.edu/biology/files/gbi-images/weedyredricefield.jpg>

Why is it important to try to control weedy rice?

- Seed production fields
 - ZERO TOLERANCE
 - If a field is found infested with Weedy Rice, it will be removed from seed production
- Other than seed production
 - No regulatory actions (no quarantine, etc.)
 - Same species as rice



Photos from: Timothy Blank, CCIA

High Diversity



Photos: Timothy Blank, CCIA

Weedy Rice Populations

5 identified types:

➤ Type 1:

- Awnless
- Straw hull color
- Tall stature
- No color on nodes

➤ Type 2:

- Awnless
- ***Bronze hull color***
- Tall stature
- No color on nodes

➤ Type 3:

- ***Awned***
- Straw hull color
- Tall stature
- No color on nodes

➤ Type 4:

- ***Awned***
- ***Black hull color***
- ***Short stature***
- No color on nodes

➤ Type 5:

- Awnless
- Straw hull color
- Tall stature
- ***Purple-colored nodes***

- **Type 1:**

- Awnless
- Straw hull color
- Tall stature
- No color on nodes

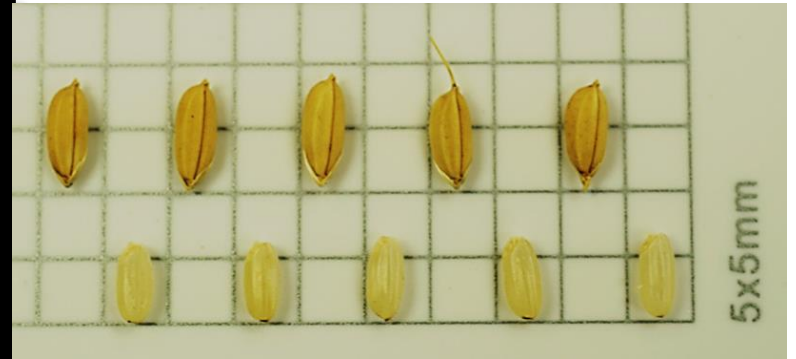






- **Type 2:**
 - Awnless
 - ***Bronze hull color***
 - Tall stature
 - No color on nodes

Bronze-hulled, Awnless



Source: Kent McKenzie

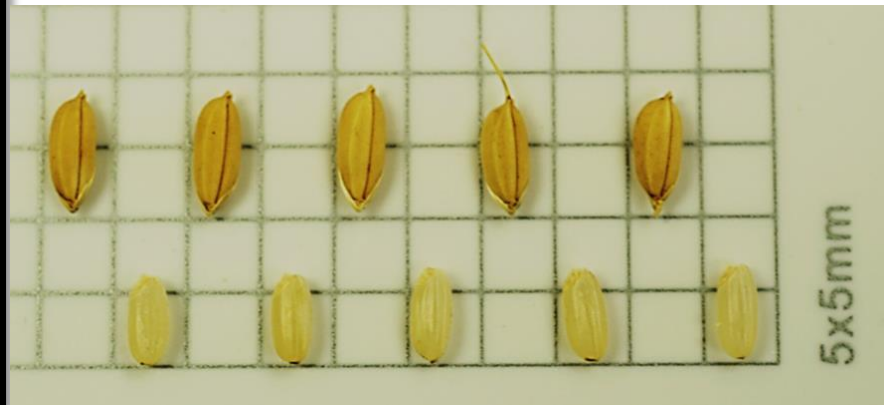
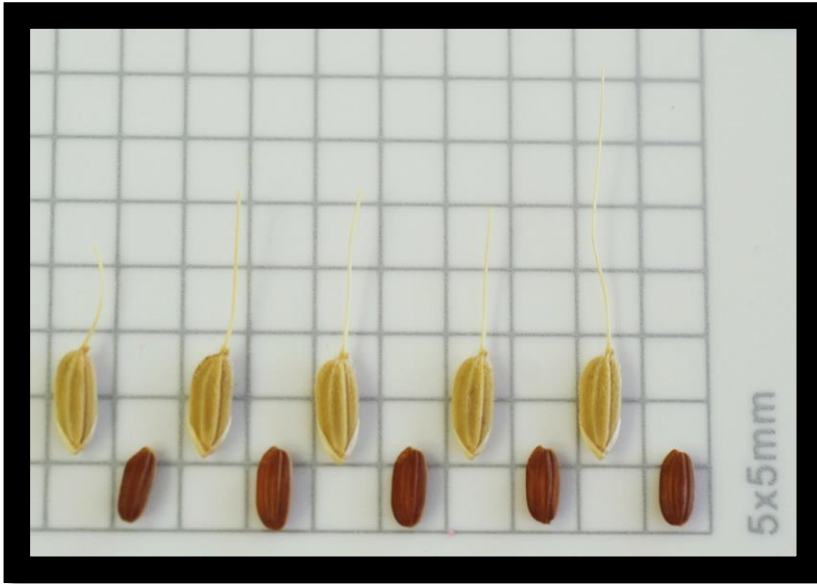






- **Type 3:**
 - *Awned*
 - Straw hull color
 - Tall stature
 - No color on nodes

Straw-Hulled, Awned



Source: Kent McKenzie







- **Type 4:**
 - *Awned*
 - *Black hull color*
 - *Short stature*
 - No color on nodes





- **Type 5:**
 - Awnless
 - Straw hull color
 - Tall stature
 - ***Purple-colored nodes***

A photograph of a dried rice panicle and a piece of straw against a black background. The panicle is composed of several branches, each bearing a cluster of small, golden-brown rice grains. The straw is a single, long, light-brown stalk. A few loose grains are scattered on the black surface. Two light blue labels are positioned at the bottom left of the image.

SUTTER

YOLO



THERE MAY BE OTHER
POPULATIONS PRESENT IN
CALIFORNIA!

Identification at Panicle Initiation



Identification at Panicle Initiation

1. Once all herbicide applications have been made to control watergrass...
2. Watergrass-like plants still visible in the field
3. Check plants to see if there is a ligule
4. If ligule absent, then it is a watergrass species
5. **If ligule present, time to call UCCE Advisors for help!**

Identification at Heading



1. Rice panicles visible in the field that are different from your planted variety
2. **Call UCCE Advisor to inspect!!**
3. Can be Bakanae, a genetic abnormality, or a seed contaminant of a different variety



Photos from Timothy Blank, CCIA

What to do (prevention)?

- Only plant certified seed
- **DO NOT** save seed
 - Mutants can propagate and spread
 - If you have an infestation, it will be over all acreage!!
- Clean equipment on farm
- Make sure that equipment coming onto the farm is cleaned
- If infested, perform operations LAST in infested fields

Management for Infested Fields

- Best Management Practices are available at: rice.ucanr.edu
- Cultural practices are only means of in-season control
- Winter/Fall:
 - **DO NOT TILL**
 - Burn infested fields
 - Flood
- Spring:
 - **DO NOT TILL** if possible
 - Use a stale seedbed (repeated as many times as possible)
 - Fallow field or rotate, if possible
 - Hand-rogue any plants that come up
 - If plants are still there after roguing, cut off seed heads to avoid shattering in field

What do we do now?

- Be on the lookout: the more eyes searching, the better
- If you suspect you have it, report it!
 - Sample submission protocol is now in place

**NOTE: NO SUBMISSIONS WILL BE TAKEN AT THE
RICE EXPERIMENT STATION**

Sample Collection Protocol

1. If suspected, DO NOT REMOVE FROM FIELD
2. Call UCCE Rice Advisor
 - Whitney: Placer, Sacramento, Sutter, Yuba
 - Luis: Colusa, Glenn, Yolo
 - Cass: Butte
 - Michelle: San Joaquin
3. Advisor will go to field to take sample
4. Sample will be processed and results reported to submitter

Why Report??

- Information will be used:
 - To help the industry develop a management strategy
 - To develop management tools
 - To apply for funds to develop such tools
- Personal and geographical information will not be shared with any agencies or institutions outside the rice industry

Research: 2016 to 2021

1. Survey of populations and genetic analysis
2. Define morphological characteristics and biology/ecology of each population

With participating growers:

1. Determine effects of winter management practices (burning and flooding)
2. Evaluate efficacy of in-season practices (stale seedbed, fallow, etc.)

Questions?

