

A photograph of a rice field. In the foreground, several rice plants are visible, some with green leaves and some with yellowing, mature grains. A few taller, thinner weeds are interspersed among the rice. The background shows a vast field of similar rice plants stretching to the horizon under a clear blue sky. A utility pole is visible in the distance on the right side.

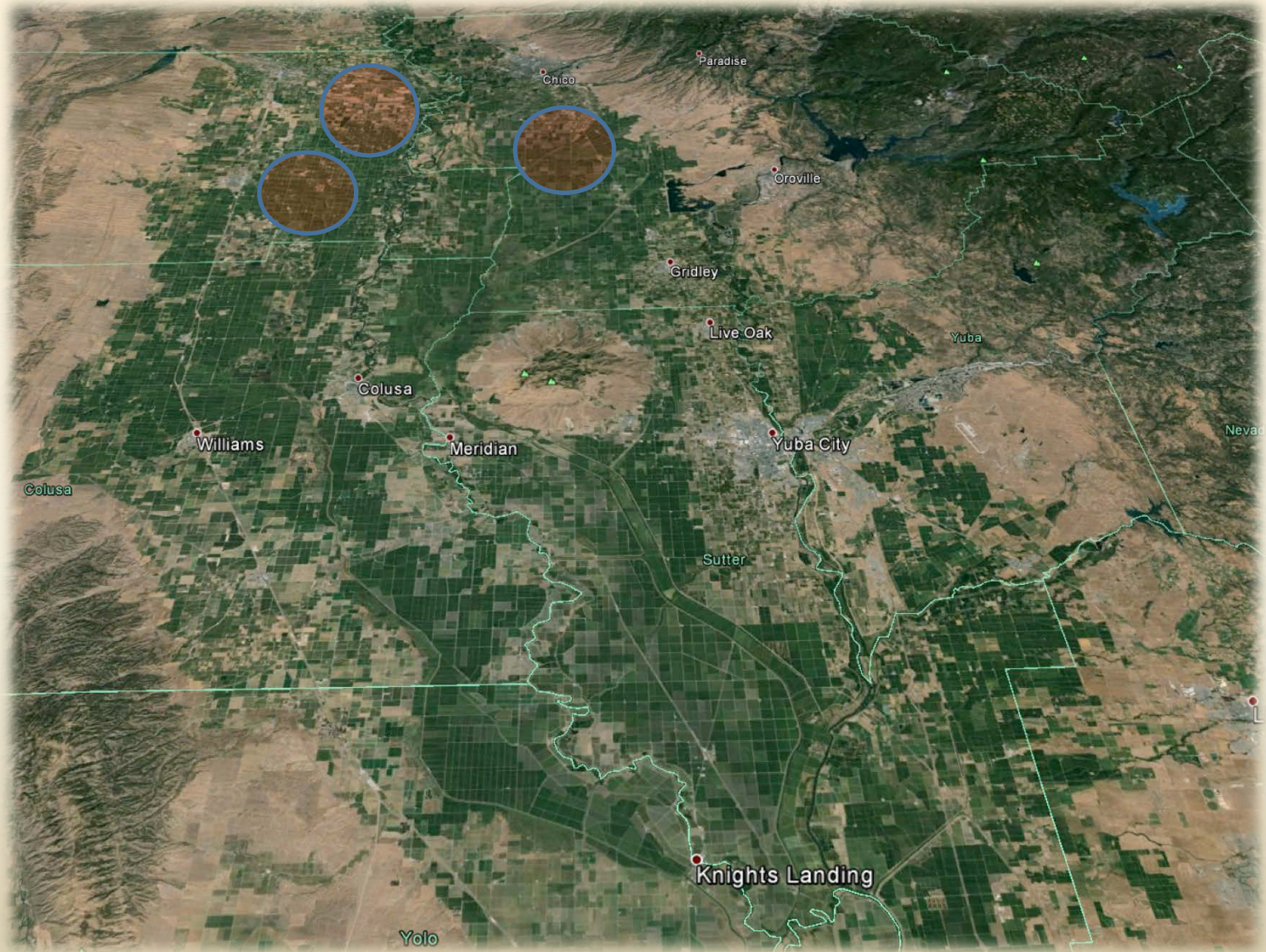
Weedy

**Red
Rice**

Update

Timothy Blank
California Crop Improvement Association

At least 3 populations in 6 fields in Glenn and Butte Counties.
At least one more unknown location reported.



Overview of Weedy Red Rice

- One of, if not the, worst weeds in rice throughout most rice growing regions of the world. In Arkansas, a 2008 survey showed 62% of fields are infested.
- Contaminated seed lots require extra milling, resulting in more cracks and reduced milling yield
- In the South, high infestations result in yield reductions of over 60%
- Hybridizes with cultivated rice.
- In CA, herbicides ineffective as weedy rice is in the same genus.
- In the South, IMR/Clearfield rice is 90%+ effective, but there are already IMR weedy rice populations due to genetic outcrossing.
- Worldwide, many species of weedy rice, but in US (South), weedy forms are *O. sativa*, *O. rufipogon*, & *O. nivara*.
- In US, general characteristics:
 - Awned & awnless types
 - Black hull & straw hull types
 - Pubescent & glabrous hull types
 - Perennial and annual types
 - Red kernels/pericarp
 - Taller than conventional rice
 - More tillers than conv. rice.
 - Lighter leaf color than conv. rice
 - Wider canopy / droopy leaves
 - Early shattering
 - Seed Dormancy
 - Seeds can persist in soil 10+ years
- **Note:** some commercial specialty red rice varieties may share some characteristics of weedy rice, such as light colored leaves, increased height, and tendency to shatter more than standard Calrose types.



Note the
height, wide
canopy and
light color

Infestations
are often in
clusters of
plants





By the time
panicle is fully
developed,
~65% of
kernels may
be shattered.



Hybrids between weedy and cultivated rice are generally more vigorous, taller, and 20-30 days later than the weedy parent



Light infestations often confused with watergrass sp.

Late watergrass (*Echinochloa phyllopogon*) collar and sheath (ligule lacking).

J. M. DiTomaso



Early watergrass (*Echinochloa oryzoides*) collar and sheath (ligule lacking).

J. M. DiTomaso



Above: Collar of **barnyardgrass** (*Echinochloa crus-galli*) (left) and **rice** (*Oryza sativa*) (right).

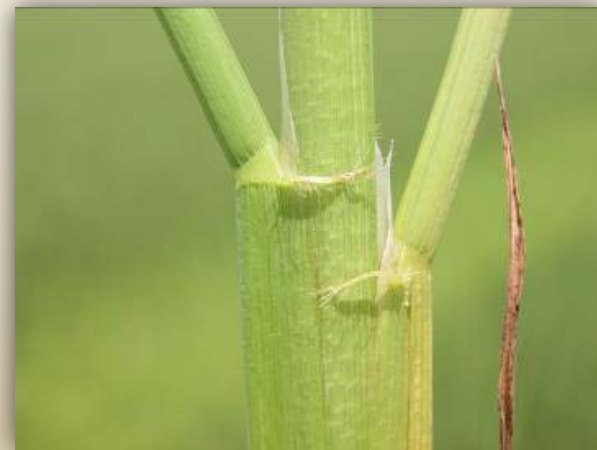
J. K. Clark

Look for differences in leaf collar. Unlike rice and weedy rice, all 3 'watergrass' species lack a ligule



Left & right: weedy red rice collar area. Ligule & auricle present.

UCCE-ANR



Light infestations often confused with watergrass sp.



Right
awnless
red rice
Below
Awned
weedy
red rice



Above
Inflorescences of
barnyardgrass (*Echinochloa crus-galli*) (left),
late watergrass (*E. phyllopogon*) (center), &
early watergrass (*E. oryzoides*) (right).

J. M. DiTomaso



Prevention!

- Only plant **Certified Seed**.
Certification standards have zero tolerance for weedy rice. Never plant seed that originated from outside CA.
 - Field standard: “All fields must be free of weedy/red rice.”
 - Combines are cleaned and inspected before harvesting of certified seed fields.
 - Seed standard for weedy/red rice: “None”
 - Seed analysis includes “*Red Rice Rubout*” where a 500 gram sample of rice is hulled using a rice huller and the grains are inspected for the presence of red rice.
- Clean equipment
 - When purchasing used equipment, ensure it is thoroughly cleaned of all seeds.
 - If you have weedy red rice, harvest infested fields last.



Control

- Rotation
- Stale seed bed method
- Shallow tillage > Fallow > irrigate > germinate > spray or till
- Water seeding and continuous flood suppress weedy rice
- Hand weeding (practical in light infestations)
- Note: One year of incomplete control can ruin years of progress. Weedy rice escapes of $\leq 5\%$ can produce sufficient seed to restore original soil seed bank population levels. (FAO)



Light green is weedy rice volunteers in heavily infested check that was fallowed and irrigated – Glenn Co.

Eradication

- Eradication has been accomplished in California before, and eradication is still possible
- If you have red rice, work with your farm advisor.
- If you don't have red rice, stay vigilant in scouting for it.
- California Crop Improvement Assn. offers to:
 - Visit with affected growers confidentially.
 - Give follow-up visits and provide inspections until weedy rice is eradicated from field.
 - *Confidentially* map all weedy rice locations.

Please contact:

- Timothy Blank
530-574-6459
tjblank@ucdavis.edu
<http://ccia.ucdavis.edu>

Sources

- http://ccia.ucdavis.edu/Crop_Standards_pages/Rice/
- California Rice Research Board: <http://www.carrb.com/Facts/RedRice.html>
- Blake, Cary. (2009) Weedy red rice threatens to reduce yield and quality for California Producers. Western Farm Press
- Vinod K. Shivrain, Nilda R. Burgos, Robert C. Scott, Edward E. Gbur Jr., Leopoldo E. Estorninos Jr., Marilyn R. McClelland, Diversity of weedy red rice (*Oryza sativa* L.) in Arkansas, U.S.A. in relation to weed management, Crop Protection, Volume 29, Issue 7, July 2010, Pages 721-730, ISSN 0261-2194, <http://dx.doi.org/10.1016/j.cropro.2010.02.010> (<http://www.sciencedirect.com/science/article/pii/S0261219410000347>)
- Shivrain VK, Burgos NR, Agrama HA, Lawton-Rauh A, Lu B, Sales MA, Boyett V, Gealy DR & Moldenhauer KAK (2010). Genetic diversity of weedy red rice (*Oryza sativa*) in Arkansas, USA. *Weed Research* 50, 289–302. <http://onlinelibrary.wiley.com/doi/10.1111/j.1365-3180.2010.00780.x/abstract>
- Valverde, Bernal E. (2013) Is herbicide resistant rice the ultimate solution to controlling weedy rice? Experiences from the Americas. *The Korean Journal of Weed Science* 33(1):11-23. https://www.researchgate.net/publication/274721494_Is_herbicide_resistant_rice_the_ultimate_solution_to_controlling_weedy_rice_Experiences_from_the_Americas
- Ferrero, A. Weedy rice, biological features and control. <http://www.fao.org/docrep/006/Y5031E/y5031e09.htm>
- Burgos, Nilda R., Norsworthy, Jason K., Scott, Robert C., and Smith, Kenneth L. (2008) Red Rice (*Oryza sativa*) Status after 5 Years of Imidazolinone-Resistant Rice Technology in Arkansas. *Weed Technology* 22(1):200-208. 2008
doi: <http://dx.doi.org/10.1614/WT-07-075.1>