

Wild Rice Breeding

"The Larry Teuber Seed Research Program"

Charlie Brummer
Tami Leathers

Plant Sciences Department
UC, Davis

Research update
16 September 2014



General comments

Charlie Brummer took over the program in May when Larry Teuber passed away. Tami Leathers worked on the project for one year with Larry and provided essential assistance this year.

The primary project is an “among and within family” recurrent selection program (see figures) to improve various traits, including shatter resistance, lodging resistance/shorter stature, synchronous maturity, improved head size and number, and others. The general idea is as follows:

1. Make selections of best families and best plants within families based on data,
2. The seed of selections is used to plant the families for next year’s selection nursery
3. New experimental cultivars arise naturally from each cycle if desired either as
 - a. Bulk seed from all selections grown in isolation
 - b. Seed from further selected “best” plants grown in isolation

The population we are using for selection has abundant variation for most traits, and gain from selection should be possible. One concern is whether true shatter resistance exists in this population. If new germplasm cannot be procured, then perhaps a mutagenesis project should be considered to generate non-shattering phenotypes.

2013 selections (Cycle 1) planted in 2014

In 2013, Larry and Tami had measured all plants in 96 families in the Davis and McArthur nurseries for various traits. After looking at the data for some time and not knowing anything about the plants or his plans, I decided to simply select the 24 top yielding families across locations, and to select the best yielding plant within each of these families in each of the blocks at each location. Because of significant sprouting of some selected plants, we added several plants from other families.

We planted 96 families into replicated trials at McArthur and Davis in early June 2014. Seed amounts varied among families. Plots were seeded dry and the plot area was immediately flooded. However, considerable time elapsed until water covered all plots. As a consequence of late planting, sprouted seed, and the time lapse until water covered the plots, stands were fair in Davis, but completely failed in McArthur.

2014 selections (Cycle 2) to be planted in 2015

Due to the uneven stands among entries and the fact that plots further from the water source had worse stands, I did not feel the stands were sufficiently reliable to be able to get good data for each family (some families only had one or few plants). Therefore, we instead simply went through the nursery and harvested the best one or two plants from the most desirable families.

We selected and harvested 179 plants last week based on the following criteria:

- tight female inflorescences without crow’s-foot phenotype
- erect tillers and a narrow crown (i.e., not “sprawling” or lodged)

Brummer and Leathers, Wild Rice Breeding Update

- large heads (long and thick)
- minimal or no disease
- preference for shorter plants
- synchronous heading
- preference for later flowering and less shattering

Of the plants selected and harvested in the nursery, we will select 80-100 based on seed weight per inflorescence and total seed weight to be included in the selection nursery next year.

Other issues

Broadening the germplasm base of the breeding program is probably the most important issue. Larry had proposed collecting populations from various fields and testing them in small plot trials. We could do that if we can figure out how to grow and, especially, harvest small plots. I'm not convinced that natural selection alone has done enough to make populations that are unique enough that they would be better cultivars for the region. The big need is for new germplasm sources, especially for later maturity, shatter resistance, and high yield. Unfortunately, the best germplasm sources are in Minnesota and are tied up in their breeding program/grower group.

Minnesota. I visited with Beth Nelson, the main lobbyist for the Minnesota growers, at the alfalfa meetings this summer (she's also a lobbyist for the alfalfa community). She was not too optimistic about the opportunities for interaction between our program and the MN program. She did suggest discussing with the scientists, and that there could be some areas of common interest to pursue. I also talked to several Univ. of Minnesota and USDA-ARS, St. Paul scientists who are familiar with the situation, and they were generally positive about possible interactions, although they are not actively working on wild rice.

I have tried through email and phone calls to contact Raymie Porter, who leads the breeding program in MN, but he has not returned my calls or email. I will continue to work on that angle. He may be at the Crop Science meetings this November in Long Beach. Hopefully I will be able to visit with him and discuss possible linkages between programs.

UPDATE (11/13/14):

I was able to visit with Raymie at the Crop Science meetings last week. The short story is that exchange of germplasm is likely to be very difficult in the near term. His program is now entirely funded by the Minnesota wild rice growers since the USDA has pulled out its support (the USDA, apparently, was not keen on continuing to fund a project that was curtailing germplasm/cultivar accessibility). Raymie indicated that there was some potential to access MN germplasm if the California growers would pay a royalty. I don't know the details on this, but it might be something to consider to broaden our germplasm resources.

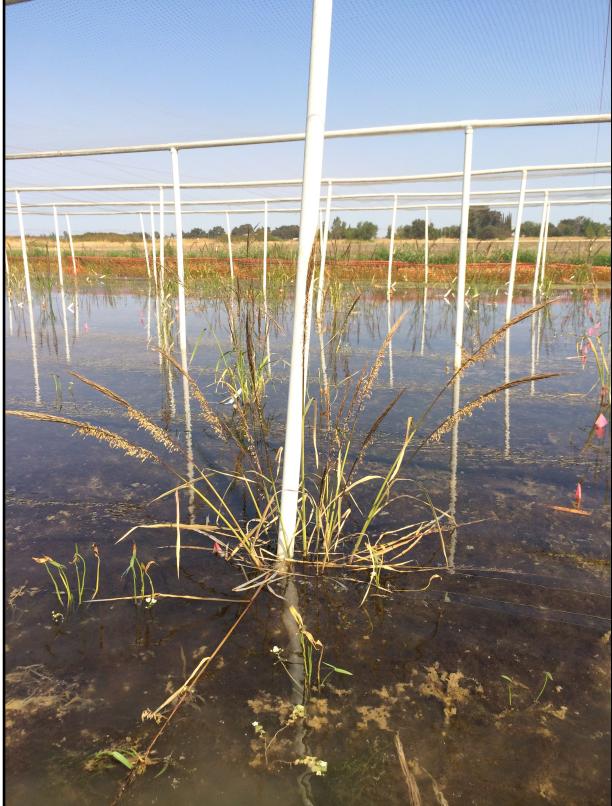
However, he was open to the possibility of collaboration on upstream research on genetics or genomics, possibly breeding methods, if an avenue for funding could be identified. I'm

Brummer and Leathers, Wild Rice Breeding Update

not sure what options really exist. He also was open to joint germplasm exploration and collection trips and to research on long-term storage of seeds, particularly for germplasm resources. The positive side of our discussion was that he, personally, seems open and willing to collaborate, but that he is constrained by the interests of the grower community in MN.

Brummer and Leathers, Wild Rice Breeding Update

Undesirable plant
Broad crown, semi-erect

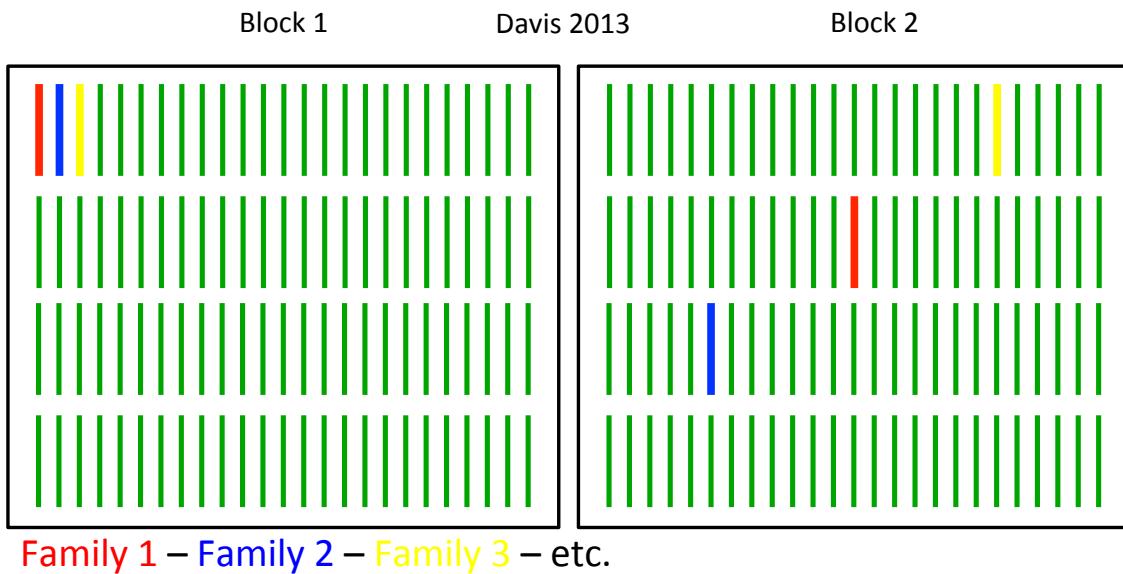


Desirable plant
Erect, narrow crown, large full heads



Among and Within Half-sib Family Recurrent Selection

100 families replicated in two blocks
Each family is a row of plants that are “half-sibs”
(half-sibs – same mom different dads)
Everything is replicated at Davis and McArthur



Among and Within Half-sib Family Recurrent Selection

