Wild Rice Notes

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Top-dressing organic wild rice – is it effective?

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Supplemental fertilizer applied as a topdressing is a common fertility management strategy. Lundberg Family Farms (LFF) top-dresses wild rice during the vegetative phase with organic pelleted fertilizers, including one from Weber Family Farms. The goal is to maximize foliage production by meeting N-P-K "hunger" during the rapid growth stage. In theory, this could increase yields, but we have not studied whether topdressing is effective in organic wild rice production.

Trial Setup

We established the field trial at Conway Farm (Yolo County). The field was seeded with Franklin variety of wild rice on May 30-31, 2017. There were only two treatments (applied as follows):

1. Treatment (top-dressed): rate was the typical rate used by LFF
   - Source - pelleted fertilizer (4% N, 4% P and 2% K) from Weber Family Farms.
   - Rate - 26 lb A^{-1} total N, 26 lb A^{-1} total P, 13 lb A^{-1} total K
   - Timing - applied 66 days after seeding (August 3, 2017)
2. Control (no top-dressing)

We harvested the field August 23 to August 24, 2017 and measured the green yield and final yield data of each field.

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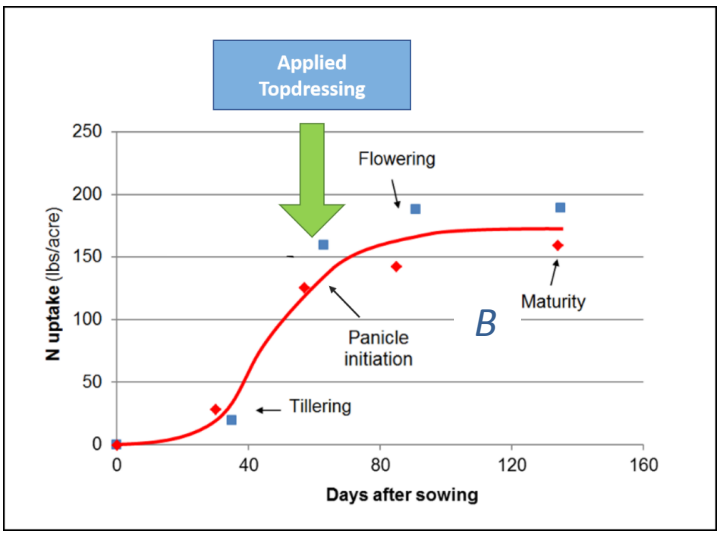

Figure 1. Adapted from FREP fertilizer guidelines for white rice (Oryza Sativa)

Timing of top-dress treatment was based on LFF standard practice. We think that an earlier application could be beneficial. One study reports that maximum nitrogen (N) release from a similar pelleted fertilizer is within 36 days of application (Wild et al. 2011). Applying earlier, up to a month before panicle initiation, could optimize the N use efficiency from pelleted fertilizer.

Results

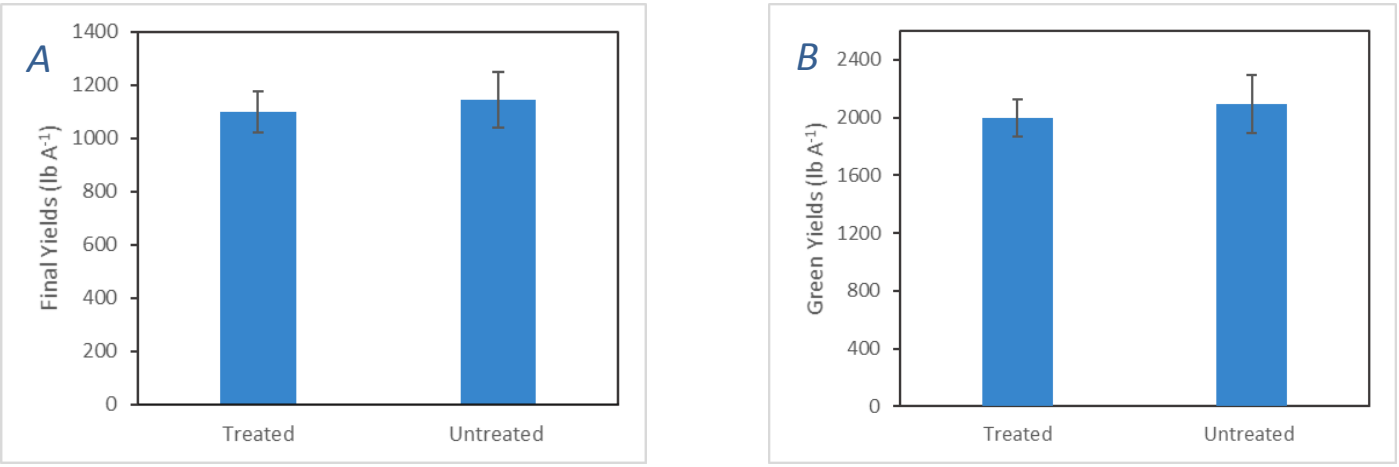

Figure 2. Final Yields (A) and Green yields (B) (lb A^{-1}) of treated (left) and untreated (right) Franklin wild rice. Treated fields were top-dressed with an organic 4-2-2 pellet fertilizer at 66 days after seeding.

<u>No statistical difference in green or dry yield in the top-dressed fields vs. untreated fields.</u>

In fact, we saw a small average decrease in yield with pelleted topdressing. We think that the pellet N-P-K (primarily N) was not immediately available at the period of maximum rice uptake.

Pelleted fertilizer supplies primarily the organic form of N-P-K which requires soil microbes to break down and release nutrients for plant uptake. In other words, the timing of nutrient supply and rice demand is off. It is

likely that microbes also tied up N during the process of breaking down pellets, which actually reduced N availability in top-dressed fields.

Our study was limited to one application rate and timing for a single growing season. Perhaps topdressing earlier in the rice growth cycle would allow time for the release of pellet N-P-K prior to the period of maximum rice uptake. Top-dressing could also be a way to manage long term soil fertility as added pelleted N-P-K may become available in the following growing seasons.

Further Research:

In white rice (*Oryza sativa*), UCCE Specialist Bruce Linquist has been conducting some trials to optimize rates for fertilizer applications upfront (at the beginning of the season), as he has found topdressing to be largely ineffective at increasing yields. We would like to pursue some of these questions in wild rice, particularly regarding chicken manure applications at the beginning of the season in organic wild rice. Top-dressing may still be a question we would like to address in more detail, especially in regards to further refining rates and timing.

If anyone is interested in being a collaborator to pursue some of these fertility questions, please contact UCCE Advisor Whitney Brim-DeForest at wbrimdeforest@ucanr.edu or at 541-292-1553.

References:

Wild, P. L., C. van Kessel, J. Lundberg, and B. A. Linquist. 2011. "Nitrogen Availability from Poultry Litter and Pelletized Organic Amendments for Organic Rice Production." *Agronomy Journal* 103 (4):1284-1291. doi: 10.2134/agronj2011.0005.

Wild Rice Seed Storage: what do we know?

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Storing wild rice seed is a challenge for growers and researchers alike. Wild rice (*Zizania palustris* L.) is native to the Northern regions of the USA and Canada where seeds evolved to overwinter at sub-zero temperatures at the bottom of lakes and ponds. Cultivated wild rice retains deep dormancy which must be broken with a period of wet chilling, scarification, or growth hormones. A few studies from Minnesota and Canada have tested the optimum time period, temperature, and moisture conditions for seed storage and germination. However, little research has been done on wild rice in California, with its warmer climate and different growing season. Furthermore, the seed storage and dormancy-breaking methods examined in most studies may not be practical for growers.

We talked to wild rice growers in California, and found that growers use a variety of seed storage practices. A standard protocol for wild rice seed storage could be useful to growers by improving stored seed survival and germination, and reducing the cost of cold storage. We combed through our archives, and found a study done at UC Davis in the 1990s on wild rice seed storage (Kovach and Bradford 1992). The conditions these researchers tested could be easily replicated on a larger scale and could save growers money.

Seed Storage Treatments:

Seeds were hand harvested and put in water to remove blanks and plant debris. The 3 storage treatments included:

1. Storage in water (wet chilling) at temperatures ranging from 37 to 86 F
2. Drying to 30 or 35% moisture content (MC) and stored at 37 to 86 F
3. Dry storage at room temperature in a paper bag

Seeds were stored for 1 year and samples were taken every month to measure seed viability and germination.

Results

Seeds stored in moist or wet conditions remained viable for up 6 months at all temperatures. After 6 months, the viability of seeds stored at >68 F decreased rapidly, probably due to microbial growth. More than 80% of seeds wet chilled at 36.5 - 50 F were viable one year later. Dry seed remained 60% viable for 5 months with a 1-month rehydration period. The optimum long-term storage method for good seed survival appears to be wet storage at 50-60 F.

The study also found that 5-6 months of wet chill is necessary to break seed dormancy. Dormancy was broken by temperatures below 55 F, and the highest germination was achieved by wet chilling at temperatures below 40 F (Table 1).

A combination of warm and cold storage was also tested: seeds were stored in 60 F water for 4.5 months and then transferred to 37 F water for 4.5 months. They report 80% germination (normal germination is 70%) and a good plant stand in the field. The wet chilling requirement to break dormancy was the same whether the seed was always stored at cold temperatures or stored warm and later transferred to cold.

A combination of warm and cold storage seems possible as long as *seeds are in cold storage (wet chilling at 35-40 F) for approximately 5 months to break dormancy.* Multitemperature storage could be a cost-saving strategy for wild rice growers that reduces the cost of cold storage.

"Naturally occurring wild rice on the St. Louis River estuary."
Photo courtesy of "MPRNews", September 2016.

Table 1. Viability (%) and germination (%) by month of wild rice seeds stored in water at different combinations of temperature and storage periods. Adapted from Kovach and Bradford (1992).

Months in storage	2	4	6	8	10	12
Temperature (F)	Viable seeds (%)					
<40	✓	✓	✓	✓	✓	✓
65	✓	✓	✓	✓	70	75
80	✓	✓	75	70	65	55
Temperature (F)	Germination (%)					
<40	0	70	✓	✓	✓	✓
55	0	15	25	20	20	20
60	0	0	0	0	5	0

*** Values greater than 80% are indicated by a check mark (✓)

Meet our staff!

Whitney Brim-DeForest is the UC Cooperative Extension Rice and Wild Rice Advisor for Sutter, Yuba, Placer, and Sacramento counties, but as the only Wild Rice Advisor, she covers grower concerns for all wild rice acreage in California. She has been working in rice systems for 15 years, first in West Africa, and then for the past 10 years, in California. She holds a Ph.D. in Horticulture and Agronomy, an M.S. in International Agricultural Development (both from UC Davis), and a double B.A. in Biology and Music from Brown University.

Hannah Lepsch served UCCE Sutter-Yuba division as a 2018 summer fellow through the UC Davis Planetary Health Center of Expertise. She assisted with farmer outreach activities and field research and created wild rice educational material. After 2 years volunteering with farmers in North Africa, Hannah completed a dual-MSc from UC Davis in international agricultural development and soil science. She recently started as a horticulture agent with North Carolina State Cooperative Extension. Hannah is thrilled to be launching her career in cooperative extension, and will apply the skills she gained from her UCCE fellowship to serve fruit and vegetable farmers in North Carolina.