Growing rice in the Delta region

A small portion of rice is grown south of Sacramento in the San Joaquin Delta. This region is unique from the major rice producing area (Sacramento Valley) due to the cooler temperatures and, in some cases, the high organic matter content of soils on which rice is grown. These issues create specific challenges to growing rice in this region.

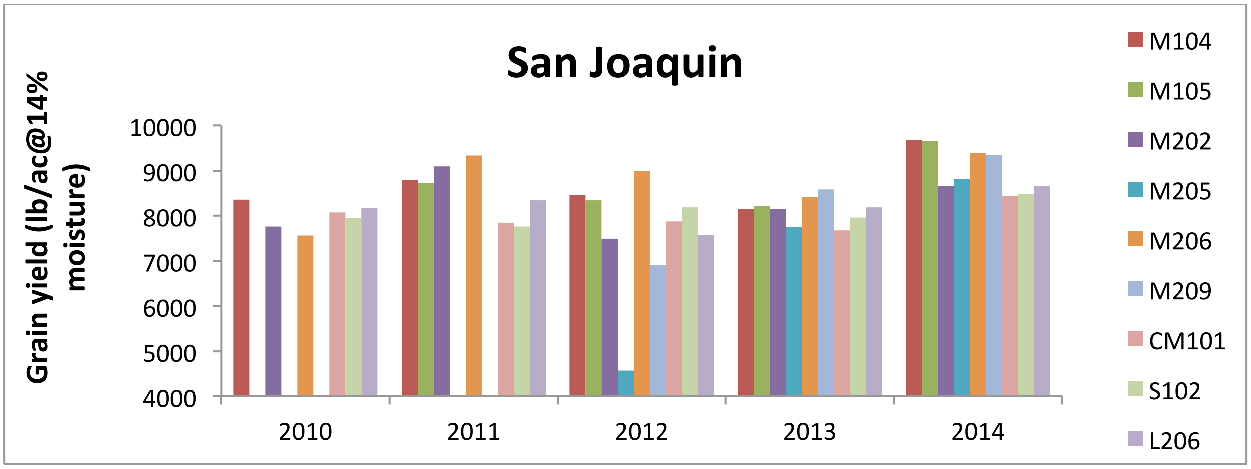
Challenges

1. Cold temperature: Cool temperatures (less than 58°F depending on variety) between panicle initiation and flowering can result in blanking which lowers grain yields. This can be partially managed by raising water levels during this period and using appropriate varieties that mature earlier and are less sensitive to cool conditions. Cool temperatures also affect how fast the crop develops and delays days to flowering and harvest.
2. Wind: Winds affect establishment. In water seeded rice high winds shortly after planting can dislodge seedlings. This can be prevented by dry seeding or if water seeding lowering the water immediately after planting until the root anchors the seedling (referred to as the Leather's method). High winds are also a problem for pest management. Most pesticides have regulations on wind speed at time of application; therefore, winds can delay or prevent timely pesticide applications.
3. High organic matter soils: In order to establish a rice crop on these soils it is recommended to dry seed the rice. This is done either by drill seeding (as one might do for wheat) or broadcasting seed and lightly harrowing in the seed. Attempts have been made to water seed rice in these soils; however stand establishment was poor as the light weight soil covered the seed which prevented germination.
4. Late harvest: Cool temperatures delay harvest as mentioned above. In addition, dry seeding also delays harvest by about 7 to 10 days compared to water seeded rice.
5. Birds: Given the relatively small acreage of rice in the Delta region, black birds can be a problem during grain fill.

Varietal selection

Take home: The medium grains M104 and M105 and specialty grains CM101, S102 and L206 are generally suitable. M202, M205 and M209 are not suitable. M206 is marginal for this region.

Varietal selection is an important decision. Given the cool temperatures that are common in the region, varieties should be chosen that are shorter duration and have tolerance to cool temperatures. The University of California Cooperative Extension (UCCE) conducts annual variety tests in the Delta region. These trials are conducted near Stockton. Full results of all varieties and across years can be viewed in the Agronomy Progress Reports located at the UCCE rice web site. Results suggest that M104 and M105 are good medium grain varieties for the region. Varieties which were not suited for the Delta are M202, M205 and M209. In cool years (as indicated by the long time to reach 50% heading) these varieties did not do well. M206 is commonly grown in the Delta but is intermediate as in some years it does not perform well (i.e. 2010 - Figure 1). The specialty varieties CM101, S102 and L206 all performed well in the Delta variety trial. In general varieties that mature earlier tend to have higher yields (Figure 2).



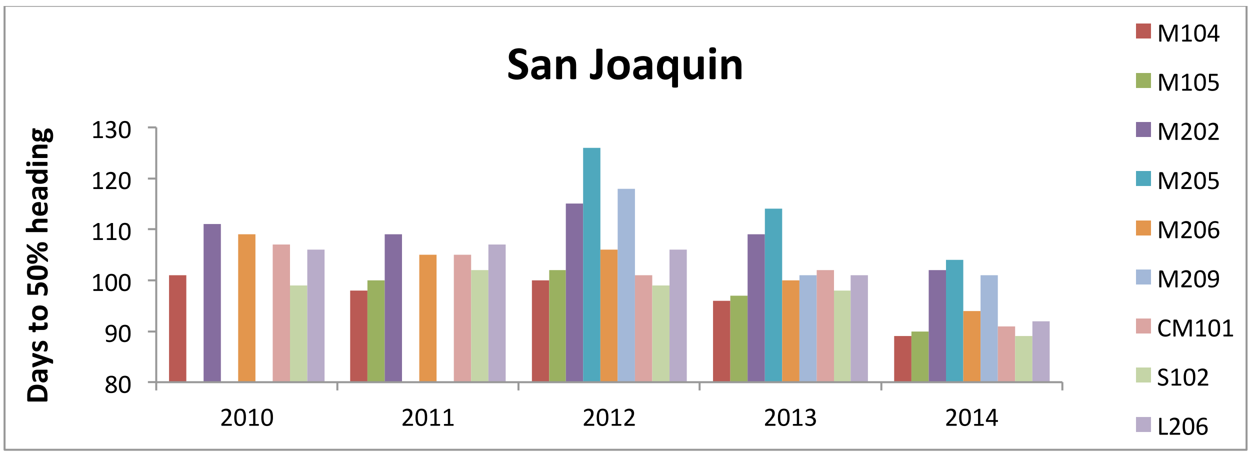


Figure 1. Yields and days to 50% heading from the San Joaquin UCCE variety trials. Full results and more years can be seen in the Agronomy Progress Reports at the UCCE rice website.

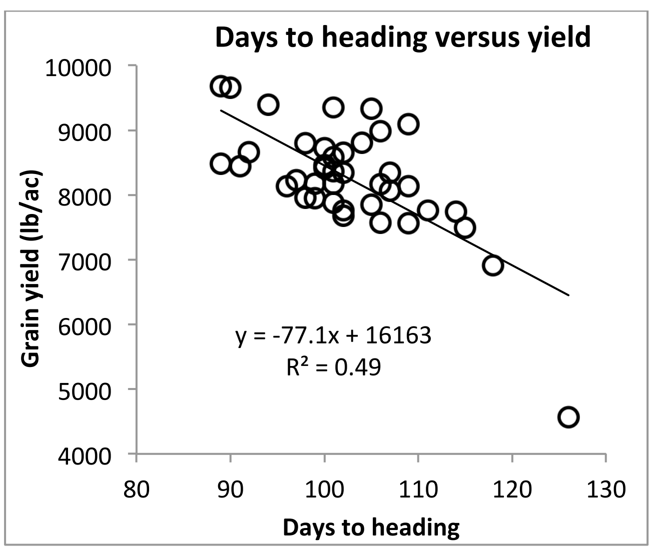


Figure 2. Relationship between days to 50% heading and grain yield. Data are from Figure 1.

On Twitchell Island which is west of the San Joaquin location and cooler, another variety trial was conducted from 2009 to 2012. We did not evaluate all the varieties at this location but rather a subset of varieties that showed good results from the San Joaquin variety trials. Note in this cooler environment that on average (varieties M104, M206, CM101 and S102 for 2010 to 2012) the number of days to heading is longer (110 vs 103 days) and that yields are lower (7580 vs 8270 lb/ac) than in the San Joaquin variety trial. At Twitchell, M206 took a lot longer to reach 50% heading than the other varieties and this probably resulted in lower yield in 2010.

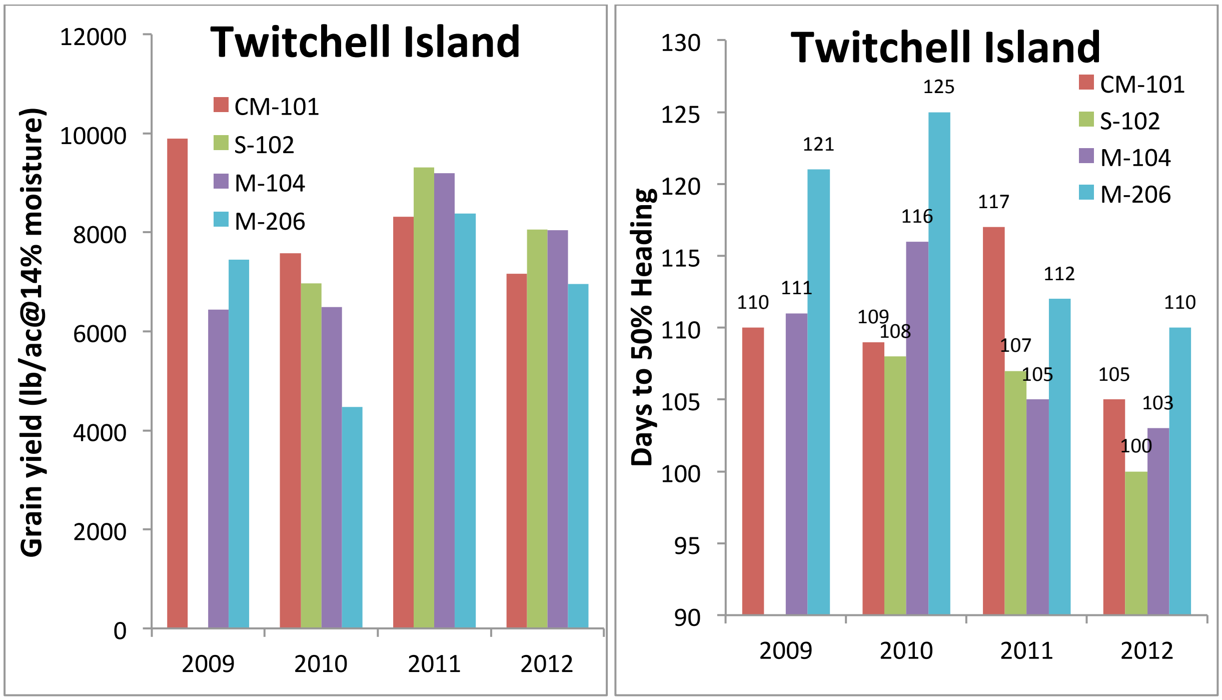


Figure 3. Grain yields and days to 50% heading for select varieites grown on Twitchell Island from 2009 to 2012.

Fertility Management

Take home: The amount of N fertilizer required, depends on the soil organic carbon content. Soils with 12 to 18% carbon did not need N fertilizer in this study. If required, all fertilizer N, P and K can be applied in a single application just before permanent flood.

For rice grown on mineral soils in the Delta region fertility guidelines will be similar to those in the Sacramento Valley. These can be seen at the UCCE rice website. However, for rice grown on high organic matter soils the fertility guidelines are different.

Nitrogen

As mentioned earlier, on high organic matter soils the rice should be dry seeded. In dry seeded rice, research (both in the Delta and elsewhere) has shown no benefit of applying N fertilizer at the time of planting. Instead, for maximum efficiency, all of the N fertilizer should be applied just before the permanent flood is established (roughly the 3 to 4 leaf stage which is 3 to 5 weeks after planting).

Determining the correct N rate is important. Applying too little N results in poor crop yields, while too much N results in delayed crop harvest and lodging which lowers grain quality and slows harvest operations. The N rate varies depending on the organic carbon content of the soil. Soils with 12 to 18% carbon (roughly 24 to 36% organic matter) did not require fertilizer N in our study. However, soils with lower or higher organic carbon contents did require N fertilizer.

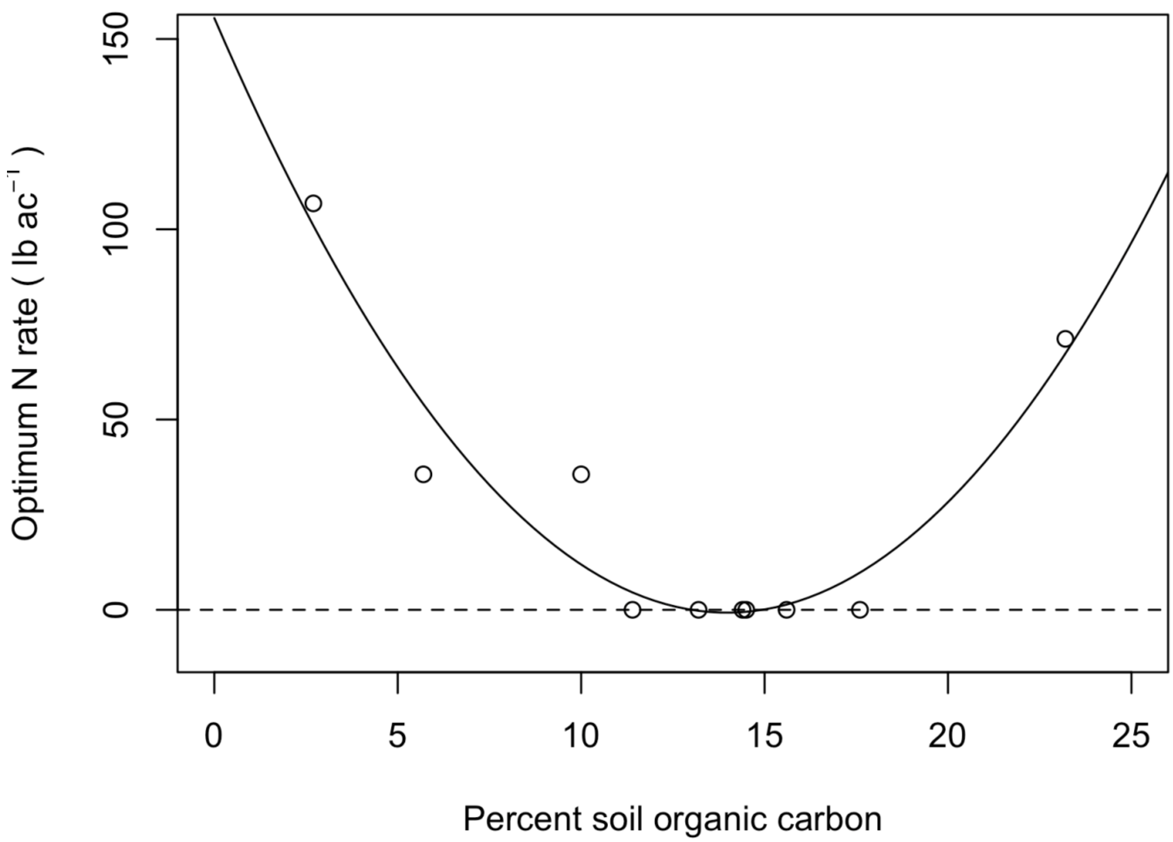


Figure 4. Relationship between soil organic carbon and optimum N fertility rate. (Data from Espe et al., 2015- Soil Science Society of America Journal).

An example of applying too much N is seen in Figure 5. The Twitchell Island soils contained between 12 and 18% carbon. In both fields, the highest yields were recorded when no N fertilizer was applied. With increasing fertilizer rates, yields declined in both fields.

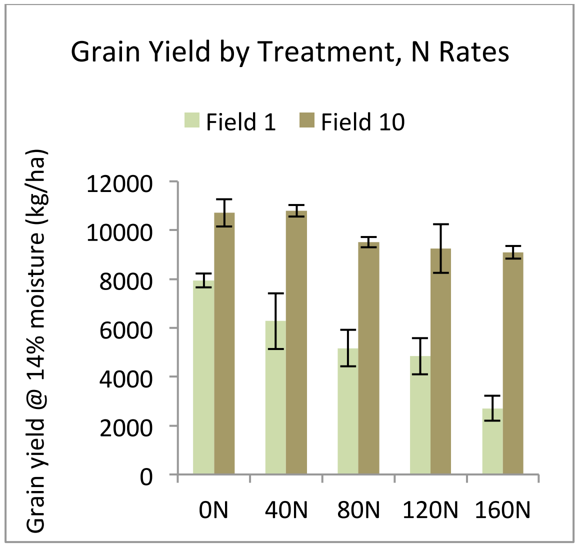


Figure 5. The relationship between N rate and grain yields in two fields located on Twitchell Island. Fields are same ones used in Figure 6.

Phosphorus (P) and potassium (K)

An experiment was conducted to determine if P and K were required, and if required, when is the best time to apply (Figure 6). The control treatment received both P and K at planting. In terms of P, there was no yield decline when P fertilizer was not added to either field indicating that, in these fields, P was not necessary. For K, yields were lower in Field 1 when no K was applied. The data show that K could either be applied at planting or just before permanent flood with similar yield results.

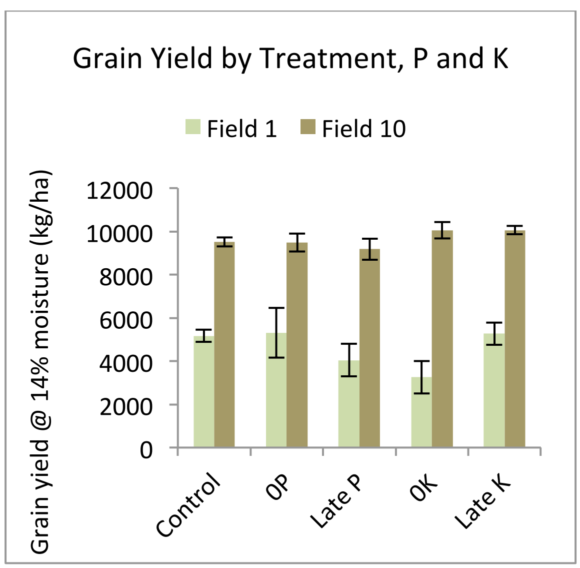


Figure 6. Yield response to P and K fertilizer. The control received both P and K fertilizer at planting. The late P and K received P and K fertilizer just before permanent flood. The fields are the same ones used in Figure 5.

These findings are important and suggest that if fertilizer N, P and K are required then a single application of N, P and K fertilizer can be made just before permanent flood.

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