Why Should We Improve Water Management In Rice Production?

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In nearly all the rice production areas of the central United States water quantity and quality has become a looming issue. Through the years there have been efforts to address water quantity concerns by simply adding new water sources in the form of new wells and larger pumps. In recent years there have been improvements in the way water is applied to the field; largely in the form of polypipe and side-inlet management. These improvements allow farmers to apply water more evenly across paddies, but do not always result in reduced irrigation water use. Current research has shifted more towards evaluating ways to manage irrigation water that will result in significant reductions in irrigation water use and not result in low grain yields. In our work we have found that using 'alternate wetting and drying' (AWD) of the rice paddy can significantly reduce irrigation water use without large reductions in grain yield. In AWD management we do not drain the field but allow it to dry, naturally, to designated soil moisture and then re-flood the field to a 4" depth. Because there can be large nitrogen losses when a field is dried we apply all nitrogen to a dry field at the 4-5 leaf stage and immediately flood the field and hold the flood for 10 days;

after which we allow the field to begin the wetting and drying process. Over three years grain yields for CLXL745, XL723, and XL753 averaged 203, 201, 192, and 177 bu. a^{-1} for the flood, AWD/40-Flood, AWD/60, and AWD/40 treatments, respectively. These yields include a continuous rice comparison in 2013. Irrigation water savings compared to the flood treatment were approximately 39, 33, and 52% for the same three treatments. In addition to these savings we found that, for the rice-soybean rotation, Global warming potential measured as the kg CO_2 eq. Mg^{-1} rice was reduced from 301 for the flood treatment to 181, 36, and 72 for the AWD/40-F, AWD/60, and AWD/40 treatments, respectively. For the continuous rice rotation these values were 476 for the flood treatment and 235, 50, and 69 for the AWD/40-F, AWD/60, and AWD/40 treatments, respectively. Between rotations, nitrous oxide emissions were greater in the rice-soybean rotation while methane emissions were greater in the continuous rice rotation. For both rotations total GHG emissions and GWP decreased as the amount of irrigation water applied decreased. We have also found that arsenic levels decrease as irrigation water decreases. Together these findings illustrate three clear benefits to growing rice under AWD management. They did so without significantly decreasing grain yields.