Long-Term Safflower Cropping Systems Experiment near Ritzville, WA.
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We completed a 6-year experiment in 2015 to evaluate the potential for safflower (SAF) in a long-term dryland cropping systems experiment on the Ron Jirava farm located west of Ritzville, WA. Safflower was grown in a 3-year winter wheat (WW)-SAF-undercut tillage summer fallow (UTF) rotation and was compared to WW-spring wheat (SW)-UTF and WW-UTF rotations. Each phase of all rotations was present each year and there were four replicates. Individual plots were 30 ft x 500 feet. Soil water was measured in all plots after grain harvest in August and again in early April, and from UTF in early September. Treflan, a soil-residual herbicide, was applied in March or April to be rain incorporated into plots that were to be sown to SAF. Safflower was direct seeded into the standing stubble of the preceding WW crop at a rate of 40 lbs/acre + N, P, and S fertilizer in late April or early May. Excellent stands were always achieved. Grain yield was determined with a commercial-sized combine and a weigh wagon in mid-to-late September. Safflower seed yields ranged from 125 to 1130 lbs/acre and averaged 483 lbs/acre over the six years.

Due to safflower’s relatively high soil water use, crops grown after SAF sometimes produced lower grain yield than those following wheat. The water shortfall carried through a year of fallow after SAF harvest compared to a year of fallow after SW or WW. At time of planting for WW in early September, fallow in the WW-SAF-UTF rotation contained an average of 1.35 inches less soil water in the 6-ft profile compared to the WW-SW-UTF and WW-UTF rotations. Figure 1 shows WW grain yield at the Ritzville site in three rotations for four cycles. By far the highest average WW grain yield of 68 bushels/acre was in the WW-SW-TSF rotation. The next highest average WW grain yield was 60 bushels/acre in the WW-TSF rotation. The lowest average WW grain yield of 55 bushels/acre occurred in the WW-SAF-TSF rotation.

Although the 4-cycle average WW grain yield is lowest in the WW-SAF-TSF rotation, the only statistically significantly within-year WW yield differences between the WW-SAF-TSF and WW-TSF rotations occurred in 2012. Winter wheat yields in these two rotations were not statistically different in 2013, 2104, and 2015 (Figure 1). This indicates that SAF may be providing a rotation benefit to the subsequent crop that offsets its well-documented high soil water use.
Figure 1. Winter wheat grain yield in three crop rotations at Ritzville, WA during four years and the 4-year average. Some readers may be confused as to why we only have four “cycles” of data shown here despite having grown and harvested safflower for six years. The reason is there is a year of fallow in all three rotations before winter wheat is planted. Thus, we will not have the full data set until after the 2017 winter wheat harvest. Numeric values at the top portion of the data bars are winter wheat yields. Yields of the preceding spring wheat and safflower in the two 3-year rotations are also shown within the data bars. Within-year winter wheat yields followed by a different letter are significantly different at the 5% probability level.