10 Years of cover crops in a no-till wheat-sorghum-soybean rotation

How do cover crops influence the cropping system?

Kraig Roozeboom, Anita Dille, Peter Tomlinson, Gerard Kluitenberg, Nathan Nelson, Kevin Arnet, Matti Kuykendall, David Abel, Giovani Preza Fontes

A. Yields averaged over 3 cycles:

a. Grain sorghum yields (Figure 1; see also Field Day Stop 3, Peter Tomlinson)

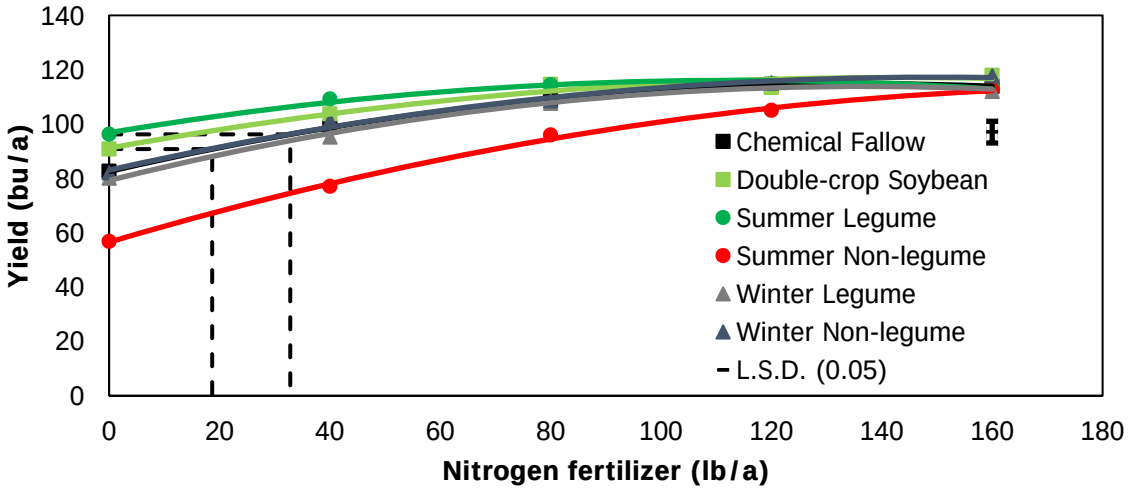

Figure 1. Grain sorghum yield response to nitrogen fertilizer and to treatments imposed between wheat harvest and sorghum planting; 8-year average, 2009-2016.

i. Summer legumes (cover crop or double-crop) after wheat reduced N fertilizer needed to maximize yield of following sorghum crop by 20 to 40 lb N/a.

ii. Summer non-legume (sorghum-sudangrass) after wheat increased N fertilizer needed to maximize yield of following sorghum crop by 20 to 40 lb N/a.

iii. Sorghum yields after winter cover crops (legume and non-legume) have been similar to sorghum yields after chemical fallow.

b. Soybeans: 20 to 65 bu/acre, no consistent effect of cover crop or N applied to sorghum

c. Wheat: 30 to 70 bu/acre, no consistent effect of cover crop or N applied to sorghum

d. Double-crop soybean (Figure 2): 3 to 50 bu/acre, no effect of N applied to sorghum

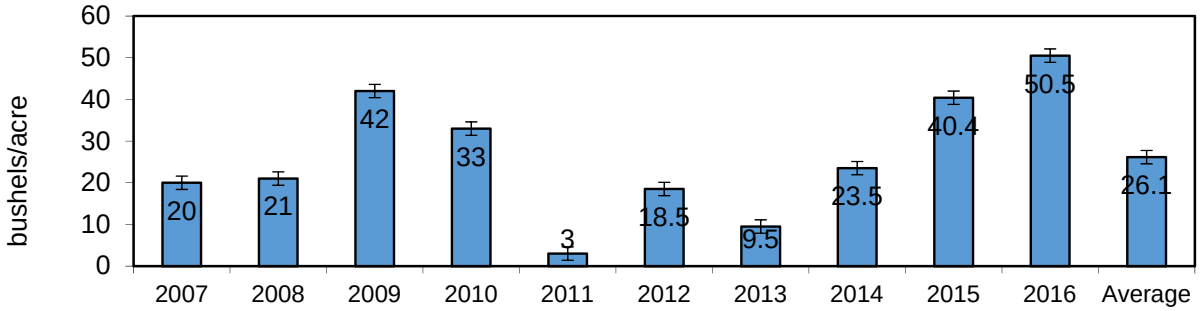

Figure 2. Double-crop soybean yields, 2007 to 2016.

B. Soil Water:

a. The fact that sorghum yields were similar following all treatments with 160 lb N/acre (Figure 1) implies that residual soil water has not been an issue on average.

b. Cash crop yields in 2012 (record-breaking heat and drought) are informative (Figure 3).

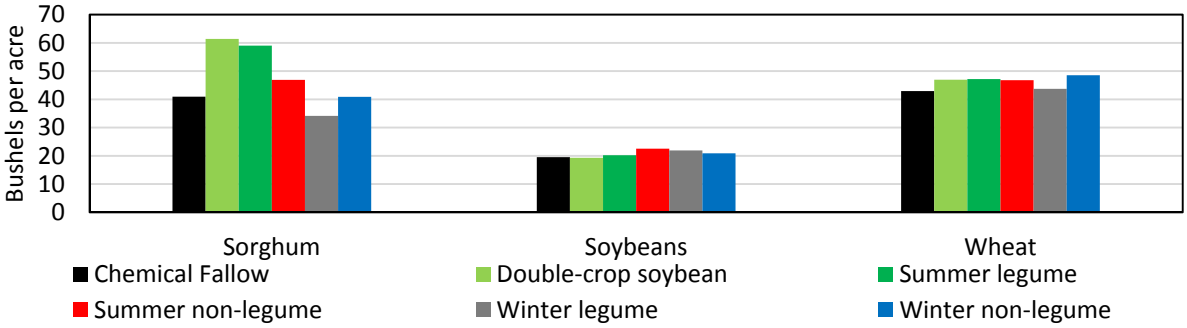

Figure 3. Cash crop yields in 2012 averaged over 5 N rates applied to grain sorghum (no response to N applied to grain sorghum in 2012).

i. The winter legume cover crop was the only treatment that reduced grain sorghum yield (Figure 3, left).

ii. Soybean (Figure 3, center) and wheat (Figure 3, right) yields with a double crop or cover crop between wheat and sorghum were equal to or better than soybean yields with chemical fallow between wheat and sorghum.

c. Soil profile water content was monitored between wheat harvest and sorghum planting in 2014-15 (Figure 4) and 2015-16 (Figure 5).

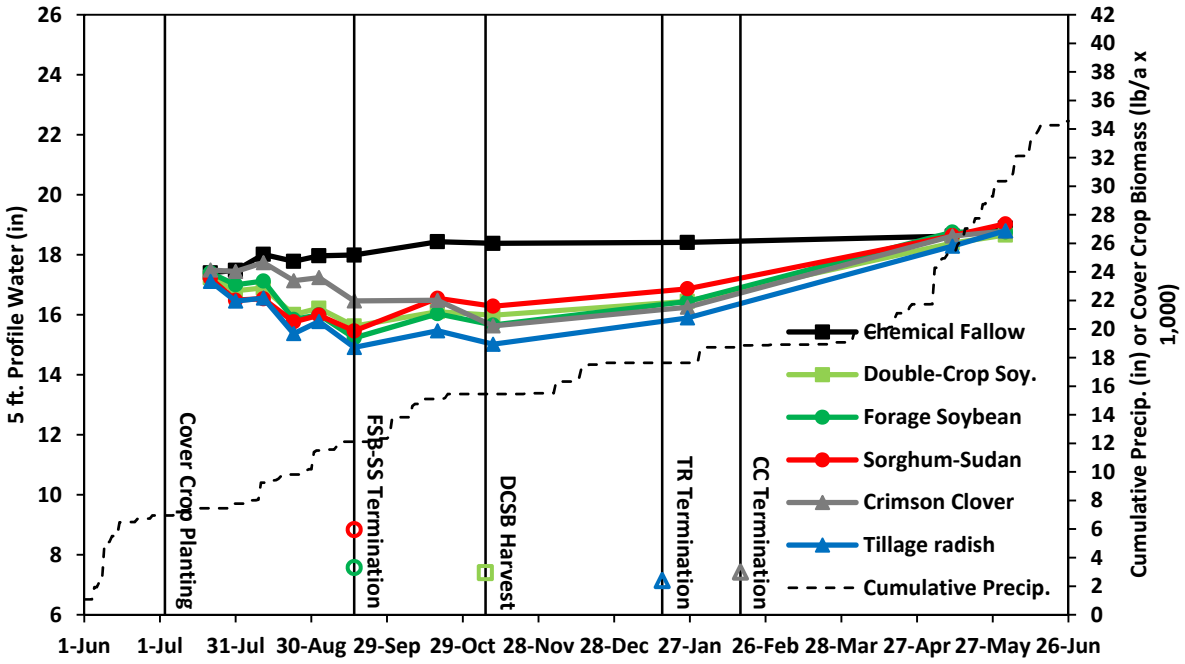

Figure 4. Soil water changes with chemical fallow, double-crop soybeans, and cover crops between wheat harvest and sorghum planting in 2014-15 (M. Kuykendall M.S. thesis).

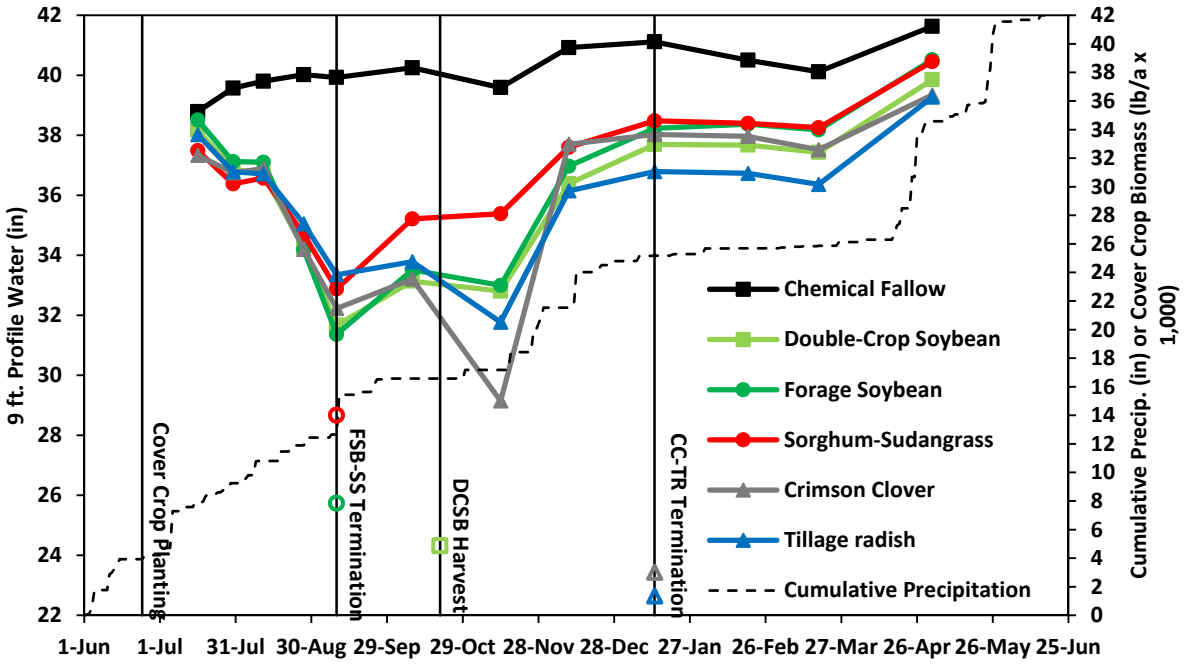

Figure 5. Soil water changes with chemical fallow, double-crop soybeans, and cover crops between wheat harvest and sorghum planting in 2015-16 (D. Abel M.S. thesis).

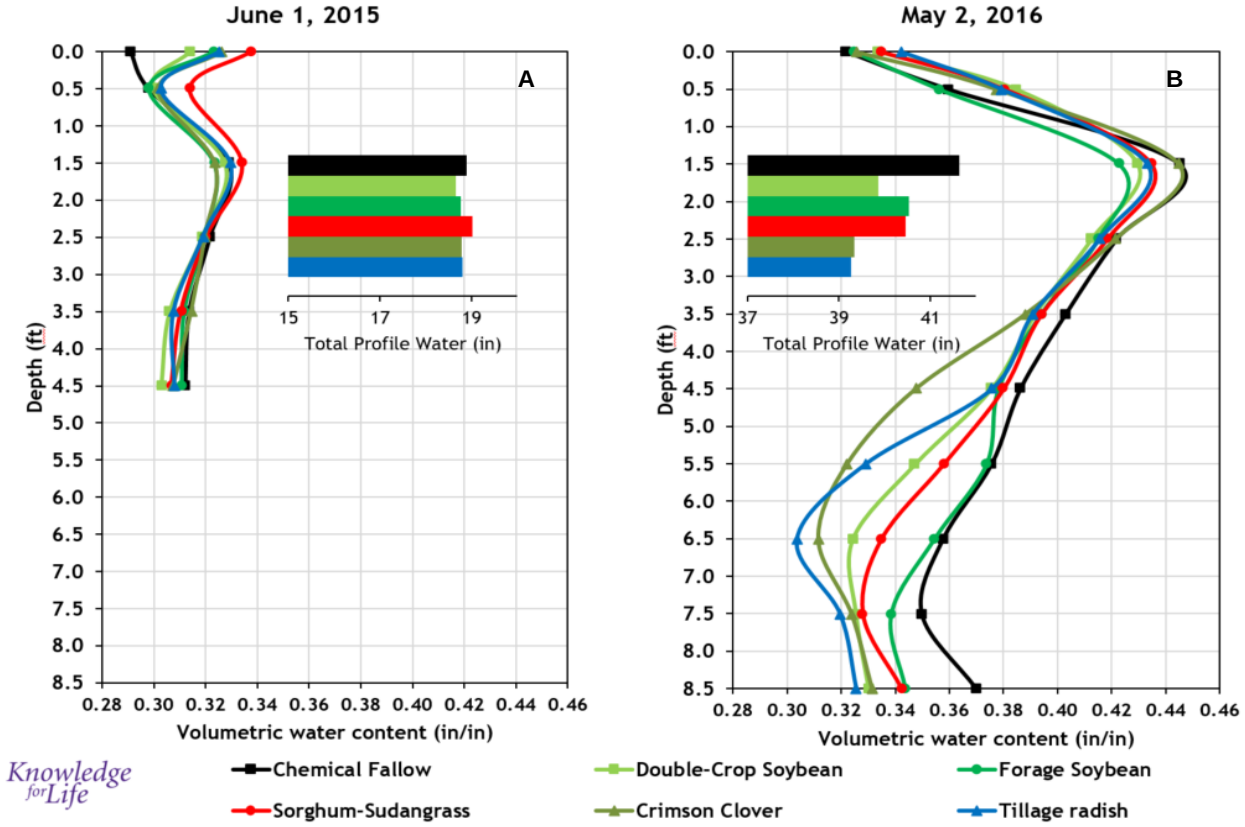

Figure 6. Soil profile water content after chemical fallow, double-crop soybeans, and cover crops before planting sorghum in 2015 (A) and in 2016 (B) (M.K. and D.A. M.S. theses).

i. Double crop soybeans and cover crops reduced soil water content compared to chemical fallow, but the 5-ft. soil profile was recharged before sorghum planting in 2015 (Figure 4, Figure 6 A).

ii. Double crop soybeans and cover crops reduced soil water content compared to chemical fallow, but only tillage radish and crimson clover maintained a significant reduction in the 9-ft. soil profile before sorghum planting in 2016 (Figure 5, Figure 6 B).

iii. Both years had substantial April and May precipitation (Figures 4 and 5).

C. Soil nutrient stratification after three cycles of the rotation (Figure 7)

a. Treatments had no impact on soil P or C concentrations at depths of 3 inches or more.

b. Double-crop soybeans may be reducing P concentration near the surface (Figure 7 A).

c. Radish cover crop may be increasing P concentration near the surface (Figure 7 B).

d. Sorghum-sudangrass increased soil C concentrations near the surface (Figure 7 C).

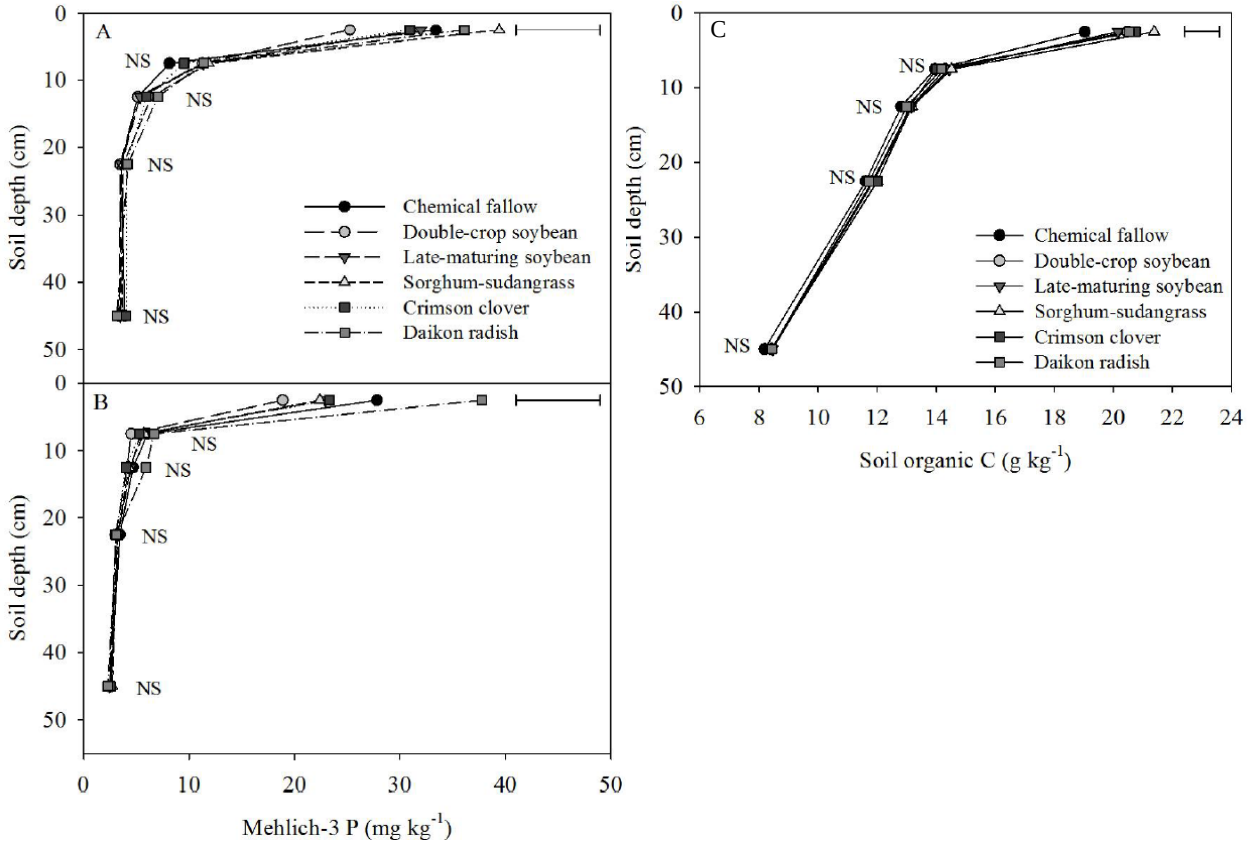

Figure 7. Soil profile phosphorous (P) concentration by depth in 2014 (A) and 2015 (B) and soil organic carbon (C) concentration by depth averaged over 2014 and 2015 (C) after 3 cycles of chemical fallow, double crop soybeans, and cover crops in a no-till wheat-sorghum-soybean rotation (G. Preza Fontes M.S. thesis).