WATER USE EFFICIENCY AND SOIL CHANGES AFTER A LONG-TERM CROP ROTATION UNDER LIMITED IRRIGATION

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ABSTRACT

Long-term crop rotation intensity and diversity can affect key soil properties. In semi-arid regions, the combined factors of rotation and soil properties may also affect the overall water use efficiency from either limited irrigation or rainfall. The objective of this study was to evaluate changes in soil properties, and water use efficiency of corn grown under different rotation intensities and diversity, and limited/supplemental irrigation. A field experiment was conducted over seven years in Gothenburg, Nebraska, to compare different irrigated crop rotations including five rotation intensities/diversity. All plots were irrigated with an annual average of 150 mm/year, and 100 mm in 2021. The annual accumulated precipitation for 2021 at the study site was 589 mm. After seven years, soil samples were collected in 2021 to include at least two full rotations for the 3-year rotation treatment. Soil samples were collected using a Giddings probe at six depths (0-5 cm, 5-15 cm, 15-30 cm, 30-60 cm, 60-90 cm, and 90-120 cm). Soil samples were analyzed for soil C using dry combustion. Grain yield was measured for every crop every year, however, data for corn yield is presented for the 2021 harvest season only. Corn grain yield in 2021 was numerically higher when following wheat in the rotation, likely due to the summer fallow after the wheat harvest allowing for additional water storage and availability to the corn crop. Water use efficiency for corn in 2021 was higher when following winter wheat in the rotation (treatments with Corn-Wheat and Corn-Corn-Wheat). After seven years (two full cycles for the 3-year rotation), soil organic matter was higher for rotations with more frequent corn in the rotation (Corn and Corn-Corn-Wheat). After seven years, continuous corn and the Corn-Corn-Wheat rotation showed significantly lower soil pH. This was likely due to the higher total nitrogen fertilizer applied over this period, which will require additional/more frequent investment in lime application. Soil carbon in the soil profile was also generally higher for rotations with high biomass and carbon input.