

Figure S1. Soil organic carbon depth profiles for fertilized long-term (56-58 yr) monoculture maize, rotation (maize-oat-alfalfa-alfalfa) and continuous Kentucky blue grass sod on Brookston clay loam soil.

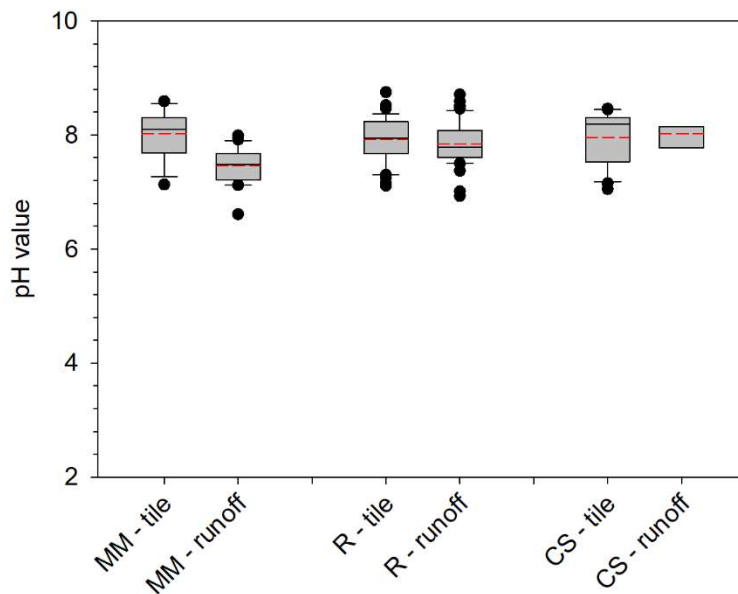


Figure S2. pH in some tile drainage and surface runoff water samples collected during March 2016 to December 2017. MM = monoculture maize, R = Rotation (maize-oat-alfalfa-alfalfa), CS = continuous Kentucky blue grass sod. Boxes indicate the 25th and 75th percentiles, T-bars above and below the box indicate the 90th and 10th percentile, solid dots indicate outliers, red dashed lines indicate mean, and solid lines indicate median.

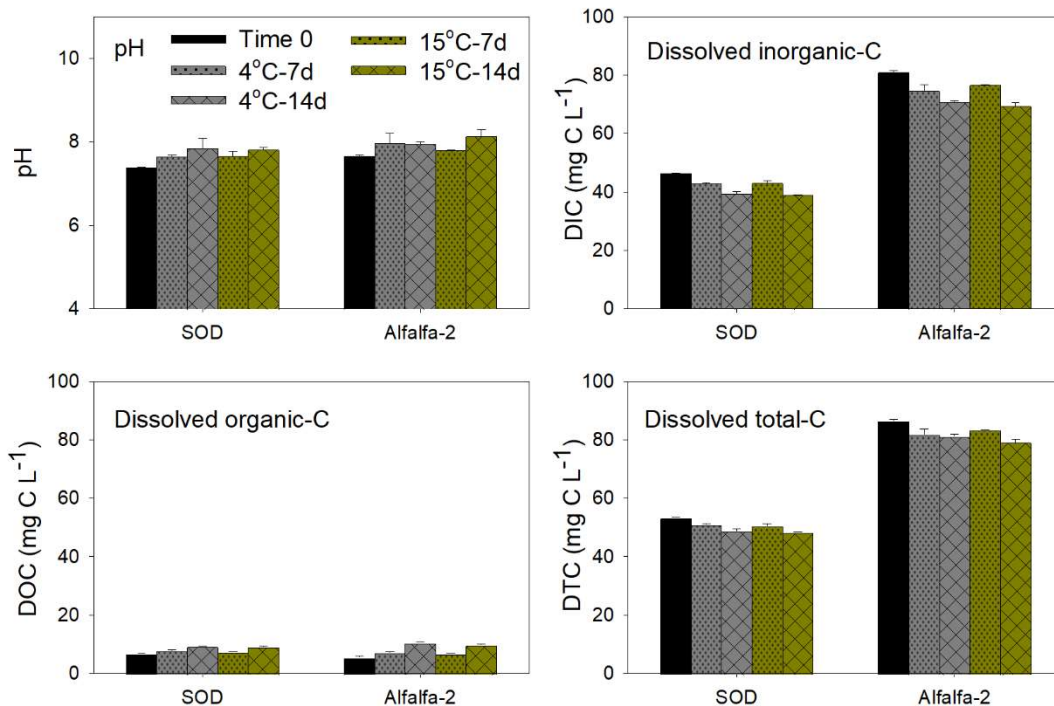


Figure S3. Changes in pH and concentrations of dissolved inorganic carbon (DIC), dissolved organic carbon (DOC) and dissolved total carbon (DTC) in surface runoff water (SOD) and tile drainage water (Alfalfa-2) over 7 day and 14 day periods at 4 °C and 14 °C. Data points are triplicate averages; error bars represent one standard deviation. On day zero, a 4-litre tile drainage sample was collected from continuous bluegrass (SOD) and a 4-litre surface runoff sample was collected from second year alfalfa (Alfalfa-2). Immediately after sample collection, the water samples were sealed in no-headspace containers, brought to the lab, and pH and dissolved carbon concentrations (total and inorganic carbon) measured in triplicate. A 500 ml aliquot (replicate) of each 4-litre sample was then poured into 6 1-L Mason jars (500 ml headspace) and sealed, with 3 jars stored in darkness at 4 °C and 3 jars stored in darkness at 14 °C. The pH and dissolved carbon concentrations in each replicate (aliquot) were then measured on the 7th and 14th days after collection. Water samples were vacuum filtrated through a 0.45 µm filter before analysis.

Table S1. Yields from annually fertilized monoculture maize (MM), rotation maize (RM), rotation oat (RO), first year rotation alfalfa (Alfalfa-1) and second year rotation alfalfa (Alfalfa-2).

	2014	2015	2016	2017	4-yr avg.
Monoculture maize (15.5% moisture content, Mg ha ⁻¹)	7.1	5.6	6.3	9.5	7.1
Rotation maize (15.5% moisture content, Mg ha ⁻¹)	10.3	10.8	11.7	14.3	11.8
Rotation Oat (14% moisture content, kg ha ⁻¹)	973	1380	1916	580	1212
Rotation Alfalfa-1 (14% moisture content, Mg ha ⁻¹)	2.4	8.0	6.6	4.7	5.4
Rotation Alfalfa-2 (14% moisture content, Mg ha ⁻¹)	3.6	7.8	5.9	5.9	5.8