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Impacts of Integrated Crop-Livestock System on Soil Health Parameters in North Dakota

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Abstract

Integrated crop-livestock system (ICLS) is helpful in diversifying a farm for improving its long-term sustainability and economic benefits. In the United States, the ICLSs have been increasing in recent years because of their economic and environmental benefits. However, the impacts of ICLSs on soil quality is not well documented in North Dakota. The objective of our study is to assess the impacts of cropping sequences and cattle grazing on the selected soil properties in the crop diversity and livestock integration practice. This study site was established in 2010 at the Dickinson Research Extension Center, Dickinson, North Dakota. The study design was a randomized complete block design with 3 replications. The cropping treatment was for comparing a 5-crop cropping sequences to spring wheat grown continuously (control, CNT). The 5 rotation crops were sunflower (*Helianthus annuus* L.)-spring wheat (*Triticum aestivum* L.)-cover crop-corn (*Zea mays* L.)-field pea (*Pisum sativum* L.)& barley (*Hordeum vulgare* L.) (S1), spring wheat-cover crop-corn-pea & barley-sunflower (S2), cover crop-corn-pea & barley-sunflower-spring wheat (S3), corn-pea & barley-sunflower-spring wheat-cover crop (S4), and pea & barley-sunflower-spring wheat-cover crop-corn (S5). The cover crop included winter triticale (*Triticosecale* Wittm.) and hairy vetch planted in September for spring hay production the following June. A 7-specie cover crop was planted for fall and winter cow grazing. Grazing treatment included grazed and un-grazed. Soil samples were collected from 0-5, 5-15, 15-30, 30-45, and 45-60 cm in the summer of 2016 and 2017. The preliminary results showed that the cropping sequences did not impact soil bulk density (BD), soil organic carbon, total nitrogen, microbial biomass carbon and nitrogen, soil water retention, carbon fractions, urease and beta-glucosidase enzymes activities. However, grazing significantly increased BD at the surface depth. The BD was significantly higher in the grazed area than the un-grazed area. Grazing did not significantly affect other soil parameters. Overall, the Integrated crop-livestock system might be neutral to beneficial to soil.