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Effect of Drought and Recovery on Grazing Animal, Microbial, and Fungal Response in a Diverse Multi-Crop Rotation

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Beef cattle grazing, soil microbial respiration, and Rhizobia spp. populations serve important roles in soil nutrient cycling and during periods of drought, when abnormal precipitation declines, forage production for animal grazing and performance are negatively impacted. Soil nutrient availability is essential for adequate crop production and extended drought reduces soil microbial activity and therefore nutrient cycling. During the 2017 growing season between April and October in the northern Great Plains region of the USA, effective precipitation for crop production and animal grazing was severely reduced due an exceptional drought as classified by the US Drought Monitor. At the NDSU – Dickinson Research Extension Center, Dickinson, North Dakota, USA, a long-term integrated system that includes yearling steer grazing within a diverse multi-crop rotation (spring wheat, cover crop, corn, pea-barley intercrop, and sunflower). Within the rotation of cash and forage crops, beef cattle graze the pea-barley, corn, and cover crop (13-specie) within the rotation and is being utilized to monitor the effects of animal, microbial and fungal activity over time and space in the crop and animal production system. Nitrogen fertilizer has been replaced in the system by soil microbial and fungal activity (Potential Mineralizable Nitrogen: 8.4 mg N/kg) such that for each 1% increase in SOM there is a corresponding increase of 18.8 kg of potential nitrogen mineralized per ha. Animal grazing days are severely reduced when precipitation is inadequate for soil microbial respiration to occur. What is even more concerning, when relying on microbial activity to supply plant nutrients, is recovery time for microbial activity to fully recover from exceptional drought as was the case in this research project. Compared to the 2016 crop production year that preceded the 2017 drought, cover crop (13-specie), pea-barley, and corn yields were reduced 86, 33, and 64% during the 2017 drought. This decline in crop production reduced the number of days of grazing by an average 50% and average daily gains were also reduced. Steer average daily gains were 1.05 0.95, and 0.83 kg/steer/day in 2017 when grazing pea-barley, corn, and cover crop, respectively. For this research that relies on soil derived plant nutrients soil analysis for microbial and Rhizobia spp. biomass began recovery in 2018 and continued into 2019 as evidenced by large percentage increases in organism biomass; however, complete production recovery did not occur by the end of the 2019 grazing season in which days of grazing were reduced compared to the 2016 grazing season. Biological animal, crop, microbial, fungal, and nutrient replacement recovery will be presented in the poster.