

ASA (American Society of Agronomy), CSSA (Crop Science Society of America) and  
SSSA (Soil Science Society of America)  
International Annual Meetings, November 6-9, 2016- Phoenix, Arizona

## **Nitrogen Cycling in a Multi-Crop Rotation in an Integrated Crop Livestock Production System**

Larry J. Cihacek<sup>1</sup>, Songül Şentürklü<sup>2,3</sup>, Douglas Landblom<sup>2</sup> and Eric Brevik<sup>4</sup>

<sup>1</sup> Professor of Soil Science, NDSU School of Natural Resource Sciences, Fargo, ND

<sup>2</sup> Dickinson Research Extension Center, North Dakota State University, Dickinson, ND

<sup>3</sup> Department of Animal Science, Çanakkale Onsekiz Mart University, BMYO, Çanakkale, Turkey

<sup>4</sup> Professor of Soil Science, *Dickinson State University, Dickinson, ND*

### **Abstract**

Integrated crop-livestock systems research at the North Dakota State University Dickinson Research Extension Center is evaluating seasonal soil nitrogen fertility within an integrated crop and livestock production system. The 5-year diverse crop rotation is: sunflower (SF) - hard red spring wheat (HRSW) - fall seeded winter triticale-hairy vetch (THV; spring harvested for hay)/spring seeded 7-species cover crop (CC) - Corn (C) (85-90 day var.) - field pea-barley intercrop (PBY). The HRSW and SF are harvested as cash crops and the PBY, C, and CC are harvested by grazing cattle. In the system, yearling beef steers graze the PBY and C before feedlot entry and after weaning, gestating beef cows graze the CC. Since rotation establishment, four crop years have been harvested from the crop rotation. Seasonal soil nitrogen status (NO<sub>3</sub>-N, NH<sub>4</sub>-N, NO<sub>3</sub>-N + NH<sub>4</sub>-N) was monitored throughout the 2014 and 2015 growing seasons from June through October in 3 replicated field plot areas within 10.6 ha crop fields with a focus on the continuous and rotational spring wheat crops. In each sampled plot area, 6 – 20.3 cm x 0.61 m aluminum irrigation pipes were pressed into the soil as enclosures to restrict root access to soil nitrogen. Soil samples were at approximately 2-week intervals from both inside and outside the enclosures. The crop rotation N values were also compared to triple replicated perennial native grassland plot areas dominated by native grass species. NH<sub>4</sub>-N and NO<sub>3</sub>-N showed similar trends across the 2014 and 2015 growing seasons. However, when soil testing these fields for fertility recommendations we have seen a decline in N rate recommendations in spite of increasing yields. The reasons for these observations will be discussed.