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Particulate and active soil nitrogen fractions in response to sheep grazing in dryland cropping systems

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Sheep (*Ovis aries* L.) grazing, a cost-effective method of weed control compared to herbicide application and tillage, may influence N cycling by consuming crop residue, weeds and returning N through feces and urine to the soil. The objective of this experiment was to evaluate the effect of sheep grazing compared to tillage and herbicide application for weed control on soil particulate organic N (PON), microbial biomass N (MBN), and potential N mineralization (PNM) at the 0-30 cm depth in a Blackmore silt loam under dryland cropping systems from 2009 to 2011 in southwestern Montana, USA. Treatments were 3 weed management practices (sheep grazing [grazing], herbicide application [chemical], and tillage [mechanical]) and 2 cropping sequences, continuous spring wheat CSW (*Triticum aestivum* L.), spring wheat-pea (*Pisum sativum* L.) or barley (*Hordeum vulgaris* L.) mixture and hay-fallow (W-P/B-F). The PON and MBN at 0-30 cm were 126 to 620 kg N ha-1 greater in the chemical and mechanical than the grazing treatment with CSW. The PNM at 15-30 cm was 7 to 13 kg N ha^{-1} greater in the chemical or mechanical than the grazing treatment in 2009 and 2011 and at 5-15 cm was 7 kg N ha^{-1} greater with W-P/B-F than CSW in 2010. From 2009 to 2011, PON at 0-30 cm reduced from 0.43 Mg N ha^{-1} yr^{-1} in the grazing treatment to 0.59 Mg N ha^{-1} yr^{-1} in the chemical treatment. Similarly, PNM at 15-30 cm reduced from 0.7 kg N ha^{-1} yr^{-1} in the mechanical treatment to 4.1 kg N ha^{-1} yr^{-1} in the chemical treatment and at 5-15 cm from 1.8 kg N ha-1 yr^{-1} with CSW to 5.1 kg N ha^{-1} yr^{-1} with W-P/B-F. Removal of crop residue during grazing but negligible N inputs through feces and urine probably reduced soil active and coarse organic matter N fractions with sheep grazing compared to herbicide application and tillage for weed control. Decline in the rate of change from 2009 to 2011 suggests that sheep grazing may stabilize N fractions in the long-term, especially in continuous cropping system.

Biography

Upendra M Sainju is a research Agronomist, USDA, ARS Northern Plains Agricultural Research Laboratory. He is currently working on the effects of tillage, crop rotation, crop diversity, cropping intensity, and cultural practices on soil aggregation, organic matter concentration, microbial activities, nitrogen mineralization, and carbon and nitrogen sequestration in dryland areas. He is also engaged in studying the effects of irrigation management, nitrogen fertilization rates, and cultural practices in nitrate-nitrogen movement in soil that affects water quality, soil organic matter level, and nitrogen mineralization in irrigated land.

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