

Small Grains Stubble Burning and Tillage Effects on Soil Organic C and N, and Aggregation in Northeastern Saskatchewan

S. S. Malhi and H. R. Kutcher

*Agriculture and Agri-food Canada, P.O. Box 1240, Melfort, Saskatchewan, Canada S0E 1A0
(Phone: 306-752-2776 Ext. 230; Fax: 306-752-4911; E-mail: malhis@agr.gc.ca)*

Field experiments were conducted over 5 years (2000 to 2004) at two sites (Star City and Birch Hills) in the Saskatchewan Parkland region to determine the effects of tillage and crop residue burning on soil total organic C (TOC), total organic N (TON), light fraction organic matter (LFOM), light fraction organic C (LFOC), light fraction organic N (LFON) and dry aggregation. Two tillage (ZT – zero tillage and CT – conventional tillage, with one tillage in autumn and another in spring) and two burning (B – residue burnt in autumn and NB – residue not burnt and returned to the soil) treatments were combined in a barley (*Hordeum vulgare* L.)-canola (*Brassica napus* L.) rotation. After five crop seasons, the mass of TOC and TON in the 0-15 cm soil tended to be greater, whereas mass of LFOM, LFOC and LFON was significantly greater in NB than B treatments at both sites. Zero tillage resulted in greater TOC, TON, LFOM, LFOC and LFON in soil than CT, in both B and NB treatments. The mass of TOC, TON, LFOM, LFOC and LFON in soil was the highest in the ZT-NB treatment, and lowest in the CT-B treatment. Zero tillage had a lower proportion of fine aggregates (< 0.83 mm diameter) and a greater proportion of large aggregates (> 6.4 mm diameter) at both sites, but the mean weight diameter (MWD) was greater under ZT than CT only at Birch Hills. Although the tillage x burning interaction was not significant in most cases, the ZT-NB treatment usually had the lowest proportion (22.6%) of fine aggregates and the greatest proportion (47.1%) of large aggregates, compared to the highest (34.9%) and the lowest proportion (35.6%) of these aggregates, respectively, in CT-B treatment. This indicated reduced potential for wind erosion when tillage was omitted (ZT) and crop residues were returned to the soil (NB). Returning crop residue to soil rather than burning usually increased soil organic C and N, and aggregation, but the differences between treatments were of greater magnitude between tillage treatments (ZT vs CT) than between burning treatments (B vs NB). Overall, returning crop residues along with ZT improved soil organic C and N, and aggregation, while burning in combination with CT resulted in the deterioration of these soil properties.