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Carbon Dioxide Exchange in a Winter Wheat Field and a Tallgrass Prairie

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Abstract.

Carbon dioxide exchange measured in a winter wheat field and a tallgrass prairie are analyzed for a complete annual cycle of growth and senescence. Both sites, located in north-central Oklahoma about 50 km apart, are one quarter section in size (65 ha). In the wheat field, traditional tillage/fertilizing practices were employed. At both sites, soil moisture was not limiting during the period reported here. Winter wheat, a C_3 species, was planted in mid October and emerged a week later. The tallgrass prairie, consisting primarily of C_4 species of grasses, was burned at the end of March and was not grazed.

Although the wheat crop remained partially dormant during the winter, there was a small net CO_2 uptake during this period (November- mid February). Rapid growth initiated in mid February. Peak daytime CO_2 flux (1.6 mg CO_2 m^{-2} s^{-1}) was observed early May corresponding to the peak green leaf area index (LAI) of the wheat canopy (5.3). In contrast, the tallgrass prairie remained a source of CO_2 until late April. The CO_2 uptake increased slowly in the prairie and the peak daytime CO_2 flux (1.5 mg CO_2 m^{-2} s^{-1}) was measured late July/early August and corresponded to the peak LAI (2.8). Peak magnitude of nighttime CO_2 exchange was larger in the prairie (-0.52 compared to -0.39 mg m^{-2} s^{-1} in the wheat).

Following the booting/heading growth stages, the daily net CO_2 uptake decreased from a peak of 10.5 g C m^{-2} d^{-1} to near zero in 3 ½ weeks. In contrast, the prairie daily net CO_2 uptake decreased from 9.3 g C m^{-2} d^{-1} to near zero in 10 weeks.