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Tillage-Induced Gas Fluxes: Comparison of Meteorological and Large Chamber Techniques

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Abstract: CO_2 fluxes from soils following tillage are usually large and decline rapidly with time. Establishing the time-course of the CO_2 flux in the early stages of the emission is important, but conventional micrometeorological techniques require large treated areas that take time to create. Hence chambers are often used to measure the flux. 'Chamber effects' may occur due to soil variability, chamber size and placement, and the level of turbulence in the chamber. We have compared chamber measurements of soil CO_2 flux after tillage with those calculated simultaneously by novel, non-disturbing, micrometeorological techniques suitable for small treated areas. The experimental area was a wheat field with some crop residue; 12 or 16 furrows were ploughed cross-wind in a strip 50m long and 5.6 or 7.3m wide. The chamber was a large (3.25 m^3), tractor-mounted, dynamic, closed chamber employing rapid mixing for fast response. Increases in both CO_2 and water vapour concentrations were measured with a Licor 6262 infrared gas analyser. Flux measurements required only 1 min. Three meteorological techniques were employed: one using a line–source solution, one using a solution for a semi-infinite strip, and one using a backward Lagrangian stochastic (bLs) model. Inputs were measurements of wind speed and gas concentrations on upwind and downwind edges of the treated area at 0.2m above the surface. Chamber and micrometeorological measurements were made for 1h before and 2h after ploughing. There was good quantitative agreement between all 3 micrometeorological methods for both CO_2 and water vapour fluxes, but the agreement between them and the chamber was variable, depending on wind speed. All methods agreed at a wind speed (at 0.25m) of 2.27 m s^{-1}, but the chambers gave higher fluxes when the wind speed was less than that value and higher fluxes above it. Interestingly, the 'wind' speed within the chamber is a constant 2.2 m s^{-1}. The clear inference is that wind speed has a large effect on gas fluxes from the tilled soil, particularly in the early stages of the emission. It is suggested that the micrometeorological techniques employed in this study provide attractive alternatives to chambers or could be used to calibrate 'chamber effects'.

Seeding System Factors Influence No-till Cropping Results

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Abstract: Seeding system evaluation trials have been conducted in low and medium rainfall regions of Southern Australia. This on-farm participatory research programme aims to answer the following question: does the technology of seeding systems matter in the success of no-till cropping? A range of commercial seeding technology attributes are being evaluated for their effects on direct drilled crop response, namely: seed banding configuration (ribbon vs conventional spread), fertiliser banding technique (deep banding vs conventional), covering device (harrows vs press wheels), soil disturbance level (disc and narrow point openers). Sample results are presented highlighting a range of machinery issues affecting direct drill crop establishment, early vigour, weed recruitment and longer term yield trends. The results highlight the potential benefits of optimising the technology of direct seeding machinery in conservation cropping systems.