Costs of deep, mouldboard ploughing at pasture renewal-to accelerate carbon sequestration and decrease contaminant bioavailability.

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Soil surveys on permanent pasture soils have identified the sharp stratification of organic carbon (OC) with depth. In many soils more than 70 % of the soil carbon stocks to 30 cm depth are in the organic matter rich topsoil (0-15 cm). In 30 year old pastures the formation and decomposition of these surface soil C stocks are often at equilibrium and stocks show little change over time. Sub-surface layers (15- 30 cm) can contain 10 times less carbon than the surface soil. When these layers are inverted by deep mouldboard ploughing and resown in a legume based sward new SOC is rapidly formed in the new topsoil (exposed sub-soil) and old OC in the ploughed under topsoil decomposes very slowly – the net effect is increased C sequestration. The new topsoil (exposed sub-soil) has low fertility with respect to N and P. Capital application of fertiliser is required to grow new pasture without a yield penalty. In some examples this cost currently cannot be offset by the current value of C credits and more added value from the deep, mouldboard ploughing is required. In dairy pasture soils highly fertilised with P, up to 90% of the added soil cadmium (Cd) and fluoride (F) loads remain within the top 15 cm. Top soil Cd concentrations at some sites exceed the Tier 2 trigger values (1-1.4 mgCD/kg soil) of the Tiered Fertiliser Management System' (TFMS) and future management under dairying will require a reduced Cd input regime. Land use change to vegetable and cereal production may require decreasing Cd bioavailability. Deep ploughing will place this contaminant load at 30-40 cm markedly reducing the contaminant load of the topsoil. Evidence for deep ploughing changing Cd bioavailability is presented and the cost-benefit analysis including accelerated C sequestration is discussed.