Burying carbon has potential to enhance carbon sequestration without reducing grass productivity

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Soil carbon sequestration is recognized in the current National Climate Action Plan 2019 as an important strategy to off-set increases in

atmospheric greenhouse gas emissions. Agriculture is ideally placed to help increase sequestration, however more information is needed on the management practices to achieve this goal. The effect of deep plowing of grassland soil on increasing soil carbon sequestration was recently investigated in an International project across multiple sites in Ireland, Germany and New Zealand.

Speaking of the project, Dr. Dominika Krol, Teagasc researcher based at Johnstown Castle, said, "Deep plowing to approximately 40 cm, inverts grassland soil depositing the carbon-rich topsoil to lower layers, effectively burying and protecting this carbon stock below the zone where soil biology is most active. Simultaneously the soil from lower layers is brought to the top. This soil is typically characterized by lower carbon content and therefore has larger capacity to absorb new carbon taken from the atmosphere during photosynthesis by the grassland sward, building up soil organic carbon stock and improving sequestration."

These studies aimed to assess the agronomic and environmental implications. Dr. David Wall, Teagasc researcher, said, "One of the key questions is how different grassland renovation methods may impact on grass biomass yield, soil nutrient supply and the main components of the ecosystem carbon cycle."

At the Teagasc Environment Research Center at Johnstown Castle, the project utilized both a field trial and a soil incubation study where a stable isotope carbon tracer was used to investigate impact of tillage method: minimum tillage, conventional and deep tillage; and grass species richness: monoculture ryegrass and multispecies swards (grass + clover + herbs) on soil carbon and biomass productivity after renewal.

Speaking of the results, Teagasc researcher Professor Gary Lanigan said, "While deep tillage successfully buried carbon-rich soil to 40-60cm

depth, carbon in the top 0-10cm layer showed little change over the duration of the project. This is not unusual as carbon build-up occurs slowly over many years and decades and therefore we plan to maintain the field trial for further long term monitoring. The use of carbon tracers revealed significant differences in net ecosystem productivity between the different tillage methods and sward types. Significantly lower grass biomass production was shown after conventional tillage compared to minimum and deep tillage methods. Grassland productivity was reduced shortly post-renovation, however, within one year of deep plowing the grass production responded positively and was significantly greater than the non-renovated pasture."

Results of this project show potential of the full inversion tillage, i.e. deep plowing to ~40 cm, as a grassland renovation method to increase carbon sequestration without any long-term adverse impact on grassland productivity. With approximately 2% of grassland soils being re-seeded each year nationally an increase of 1 ton per hectare of carbon sequestration would offset 1.4% of annual agricultural GHG emissions.

More information: SOW14-GPLER-SP23-PFR-MB: Accelerated soil C sequestration through targeted use of full inversion tillage when renewing permanent pastures & grasslands. www.teagasc.ie/media/website/p … s-and-grasslands.pdf

Provided by Teagasc

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