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**THE IMPACTS OF COVER CROPS ON NITROGEN LEACHING, NET GREENHOUSE GAS BALANCE AND CROP PRODUCTIVITY
(ВПЛИВ ПОКРИВНИХ КУЛЬТУР НА ВИЛУГОВУВАННЯ АЗОТУ, БАЛАНС ПАРНИКОВИХ ГАЗІВ ТА ПРОДУКТИВНІСТЬ ВРОЖАЮ)**

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Покривні культури відіграють все більш важливу роль у покращенні якості ґрунтів, зменшенні внесення сільськогосподарських ресурсів та покращенні екологічної стійкості. Основними завданнями цього систематичного аналізу були оцінки практики покриття сільськогосподарських культур у контексті їх впливу на вилуговування азоту, залишки парникових газів та продуктивність врожаю.

Ключові слова: *C секвестрація, збір врожаю, покривні культури, перегній, вміст N, N у зерні, N вилуговування, баланс парникових газів, нітрати, викиди оксиду азоту, органічний вуглець в ґрунті, урожай*

Cover crops play an increasingly important role in improving soil quality, reducing agricultural inputs and improving environmental sustainability. The main objectives of this systematic analysis were to assess cover crop practices in the context of their impacts on nitrogen leaching, net greenhouse gas balances (NGHGB) and crop productivity.

Keywords: *C sequestration, catch crop, cover crop, green manure, N content, N in grain, N leaching, net greenhouse gas balance, nitrate, nitrous oxide emissions, soil organic carbon, yield*

Impacts of cover crops (legume, non - legume and legume–non - legume mixed) on N leaching

The inclusion of cover crops in the crop rotation significantly decreased N leaching compared to the control treatments. All types of cover crops had significant effects on N leaching; legume, non - legume and legume–non - legume mixed cover crops. A one - way model with random effects showed no significant difference in N leaching between legume, non - legume and legume–non - legume mixed cover crops.

Impacts of cover crops on SOC and direct N₂O emissions

A paired test with random effects showed that SOC under the cover crops was significantly higher compared to that in the control treatments. Both legume and non - legume cover crops significantly increased SOC. The same test showed that cover crops had no significant effect on direct N₂O emissions, compared to the control treatment. Only legume cover crops significantly increased direct N₂O emissions but non - legume and legume–non - legume had no effects, compared to the control treatment.

Tillage had no effect on direct N₂O emissions. However, the changes in direct N₂O emissions (%) under conservation tillage were significantly lower compared to that under conventional tillage treatment [1].

Impacts of cover crops on grain yields and N in grain of primary crop

Overall, the cover crops significantly decreased grain yield of the primary crops compared to the control treatments. Both legume and non - legume cover crops significantly decreased grain yield of the primary crop whilst legume–non - legume mixed cover crops significantly increased grain yield of the primary crop. Cover crops significantly decreased grain yield of the primary crop under conventional tillage but had no effect under conservation tillage.

Influences of management, soil and climatic zones on cover crop efficiency to decrease N leaching and to increase SOC

For N leaching at 0–100 cm depth, contour plots based on available data showed that BD and N fertilizer application rate explained 11.6% of overall variance. N leaching was significantly related to BD. For the SOC at 0–30 cm depth, BD and N fertilizer application rate explained 57% of the overall variance in SOC. The increase in SOC under cover crops was significantly related to both N fertilizer application rate and BD [3].

Impacts of cover crops on net greenhouse gas balance

Cover crops increased SOC and decreased N leaching and thereby lowered the indirect N₂O emissions (i.e. from N leaching) without significantly increasing direct N₂O emissions. This combination of higher SOC and the lower indirect N₂O emissions under the cover crops resulted in a lower NGHGB compared to the control treatment [2].

Systematic analysis reveals that, by adopting cover crops, we could decrease N leaching to ground water and increase SOC sequestration without having significant effects on direct N₂O emissions. To avoid the negative impacts of cover crops on grain yield, legume–non - legume mixed cover crops, which increase the yield and had no significant impacts on N in grain, should be selected. These effects can be considered important in contributing to the resilience of farming systems to environmental changes, for example from climate change, by being more fertile, productive and have better water quality.

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