

SHORT-TERM EFFECTS OF DEEP PLOUGHING ON SOIL C STOCKS FOLLOWING RENEWAL OF A DAIRY PASTURE IN NEW ZEALAND

Soil science:
beyond food and fuel

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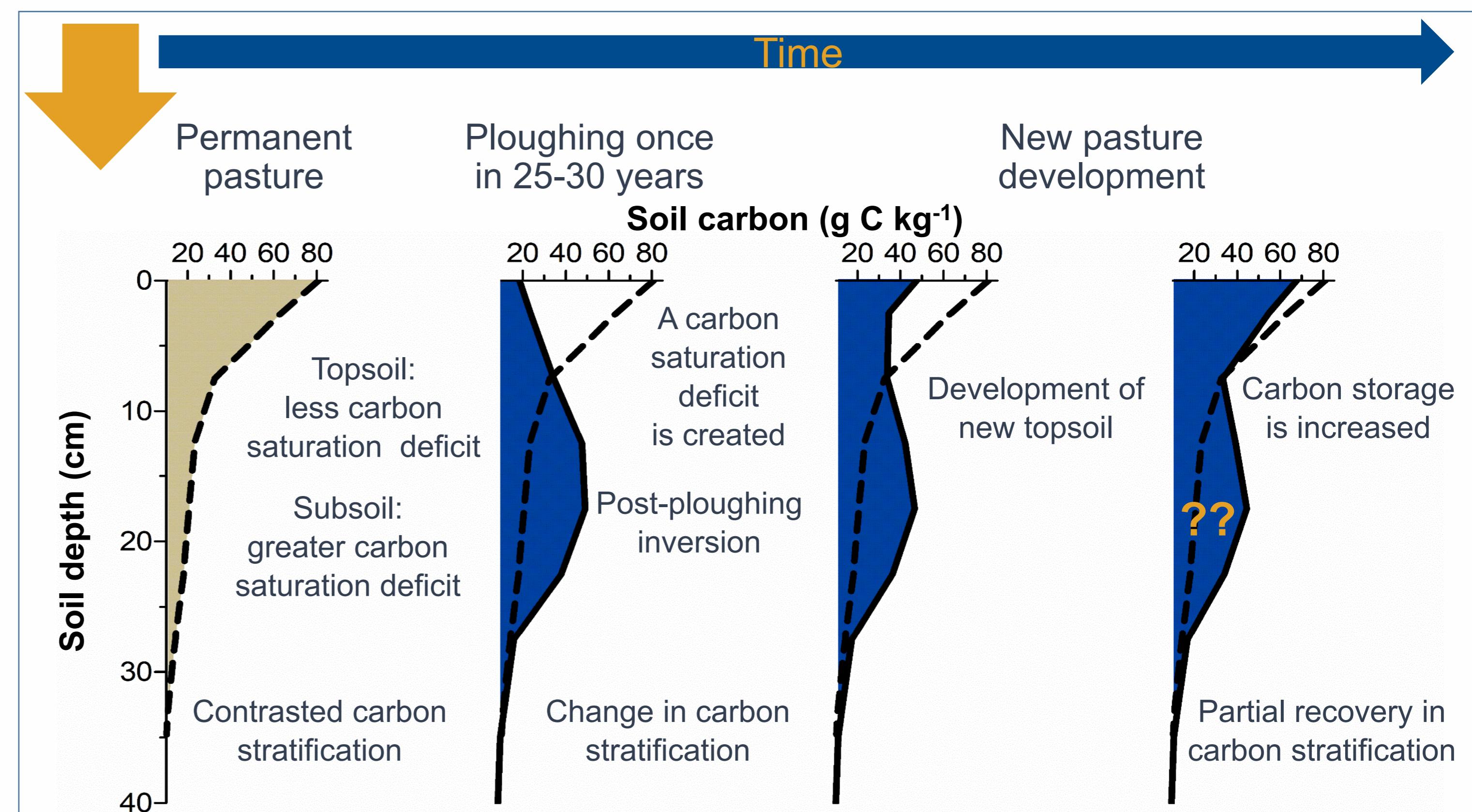


Hypothesis

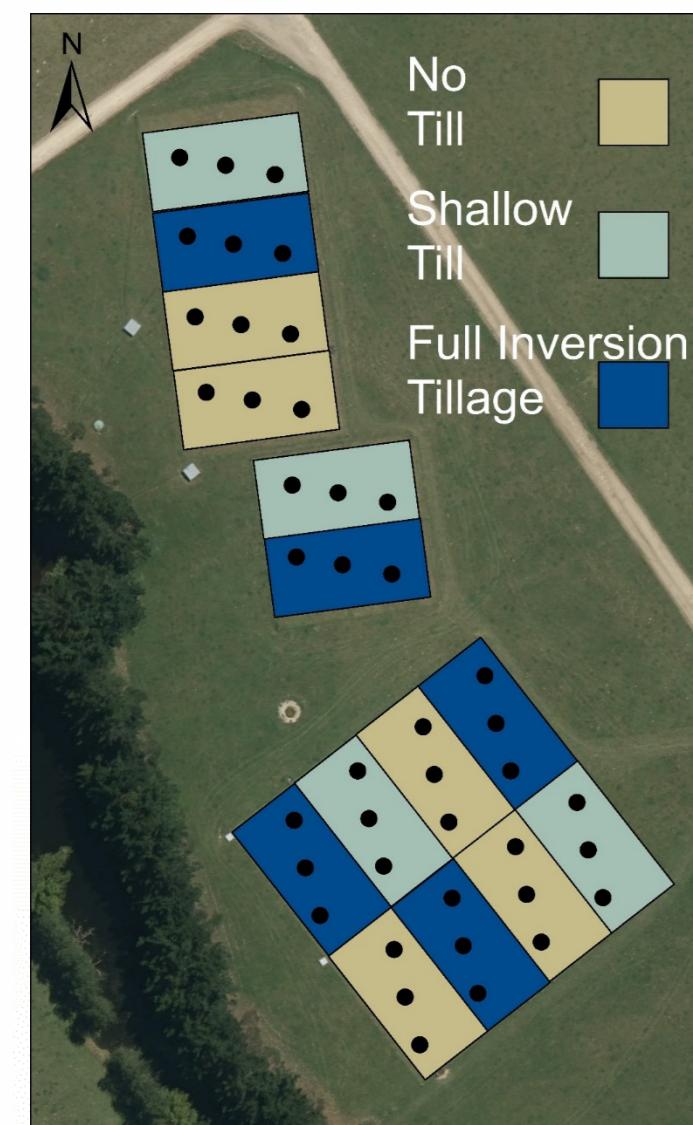
Infrequent inversion tillage of long-term pastoral-based soils may increase soil carbon storage.

Material and methods

Renewal practices (no till, shallow till or full cultivation by deep –25 cm– ploughing) followed by summer forage cropping and autumn re-grassing (Fig. 1) were studied on an imperfectly drained Typic Fragiaqualf under dairy grazing. Site was core sampled (0-40 cm; Fig 1a, ●) and monitored (plant growth, leaching) during 2016-2017 (Fig. 1; Fig. 2).



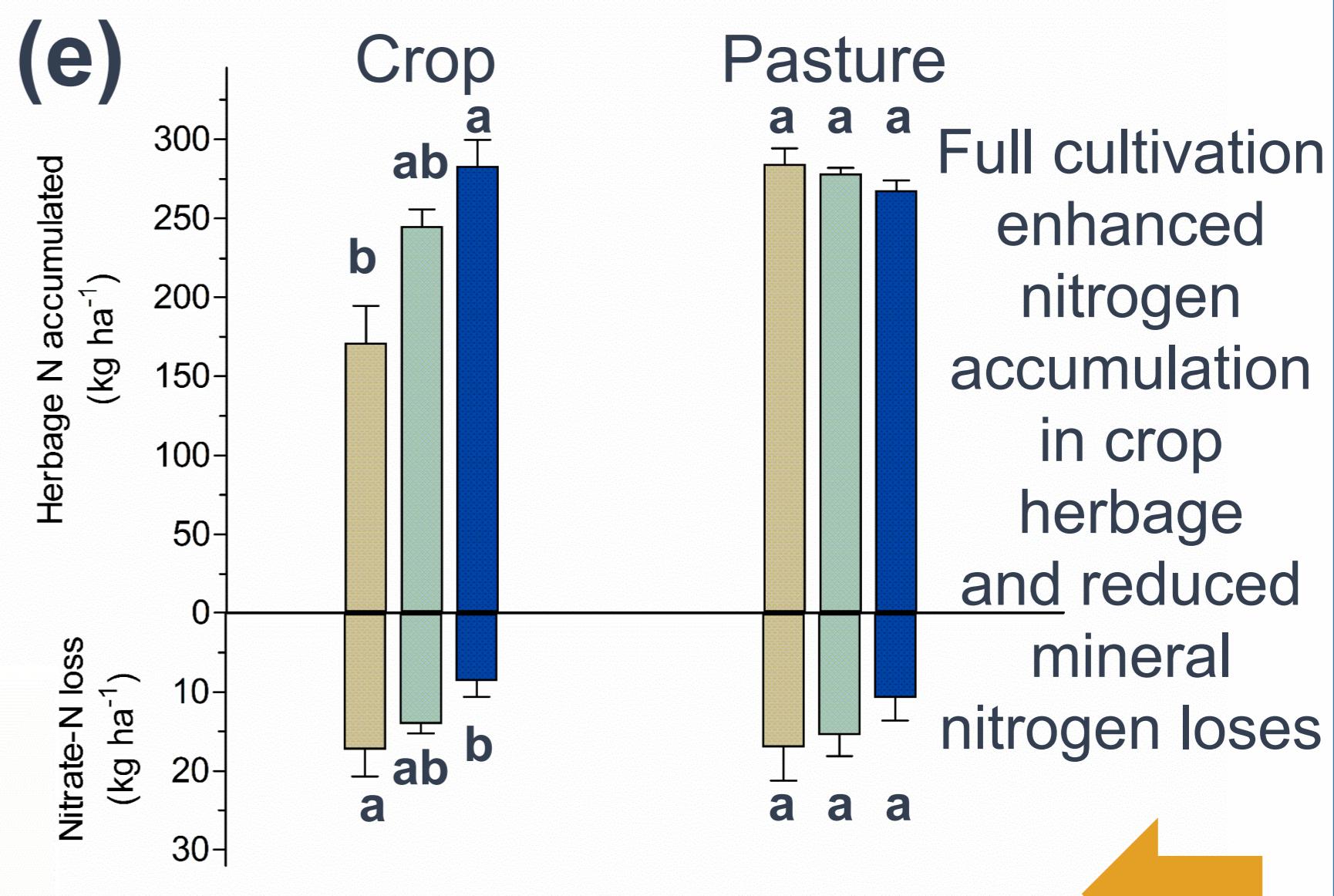
(a)



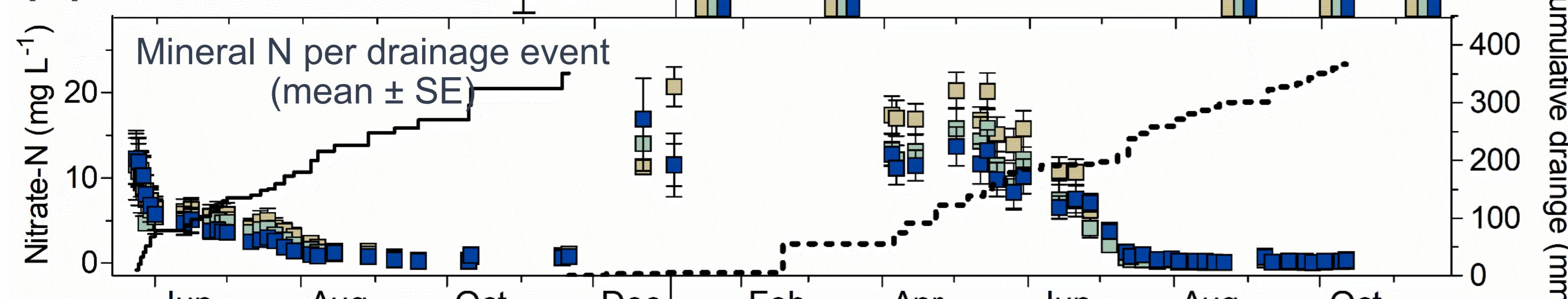
Experimental site:

Massey University, New Zealand North Island; replicated 20 x 40 m drainage plots; each plot with an isolated mole and pipe drain system on a Typic Fragiaqualf under long-term pasture (ryegrass/clover mixture; at least 10 years since previous grass renovation) grazed by cows.

(e)



(c)



(d)

(f)

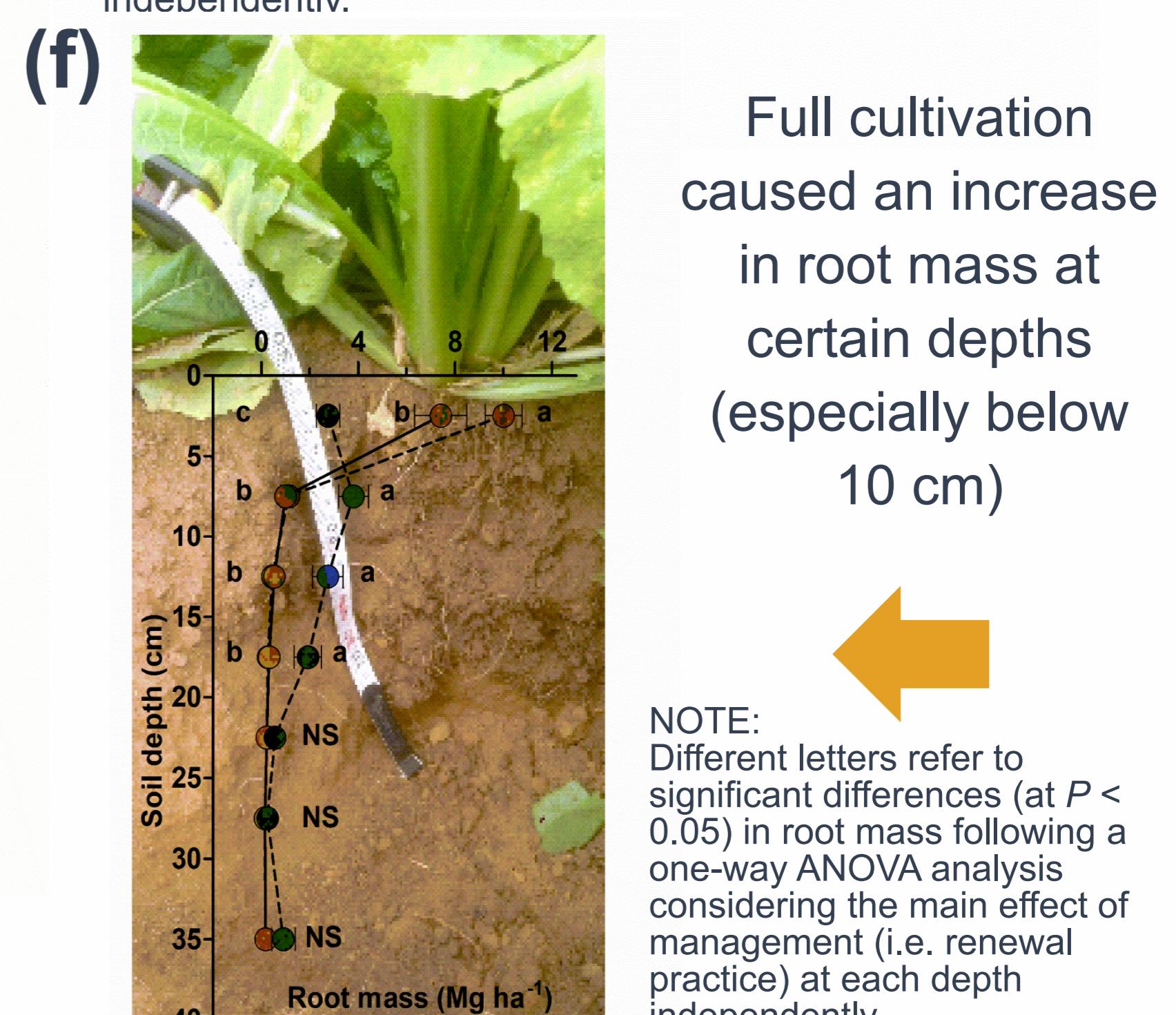


Figure 1

(a) Experimental site and experimental design; (b) herbage accumulation; (c) nitrogen (as nitrate-N) leaching and cumulative drainage; (d) crop and sampling calendar; (e) nitrogen (N) accumulation in herbage and N losses as nitrate; (f) changes in root mass assessed at the end of the crop phase.

Results

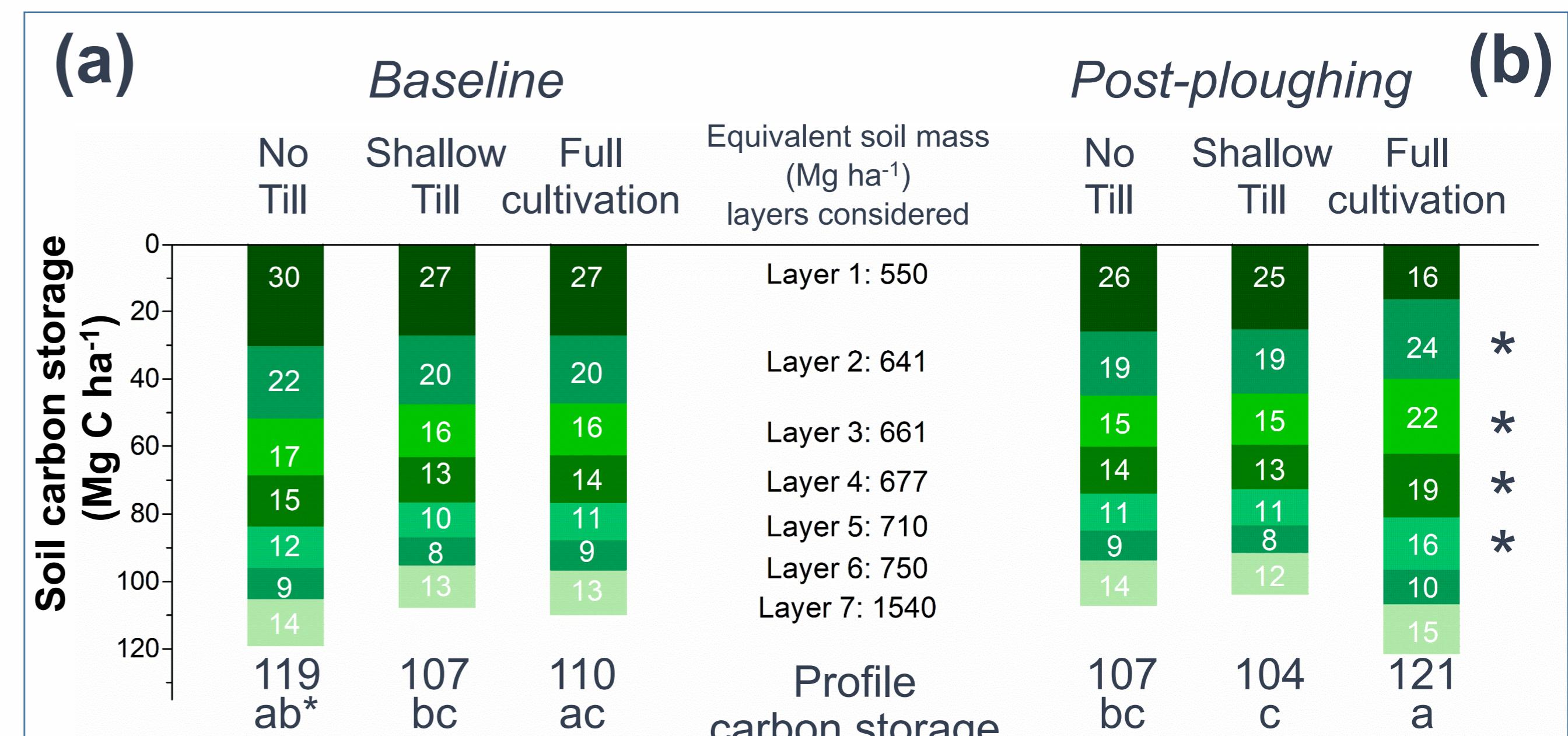
Full cultivation:

- (i) favoured crop herbage production (Fig 1b);
- (ii) enhanced crop herbage nitrogen accumulation and root development (Fig 1e,f);
- (iii) transferred soil carbon below 10 cm depth (Fig. 2; *)

Final consideration

The potential for infrequent inversion tillage increasing soil carbon sequestration as a greenhouse gas (GHG) mitigation tool is currently being tested at other sites in New Zealand.

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* Different letters refer to significant differences (at $P < 0.05$) in profile C storage following a factorial ANOVA analysis considering the main effect of management (i.e. renewal practice) and time (sampling date), and the interaction between management and time.

Figure 2

Changes in soil carbon stocks: (a) baseline (pre-ploughing); (b) 5 months after ploughing and summer crop growth.

