

Biomechanics of *Posidonia oceanica*: relation with leaf ageing and effect of collection procedure

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INTRODUCTION

Posidonia oceanica (Fig. 1)

- Shoot bundles holding several leaves.
- Outer older leaves of the shoot bundle **protect** inner younger leaves against **herbivory** and **mechanical loads**.

Hypothesis

Patterns in biomechanical and nutritional traits within the shoot are in relation to age.

Extra point

How the collection procedure (classical unrooting vs. non destructive shoot method, NDSM) and time span between sampling and testing event (24 vs. 48 h) may influence nutritional and mechanical traits.

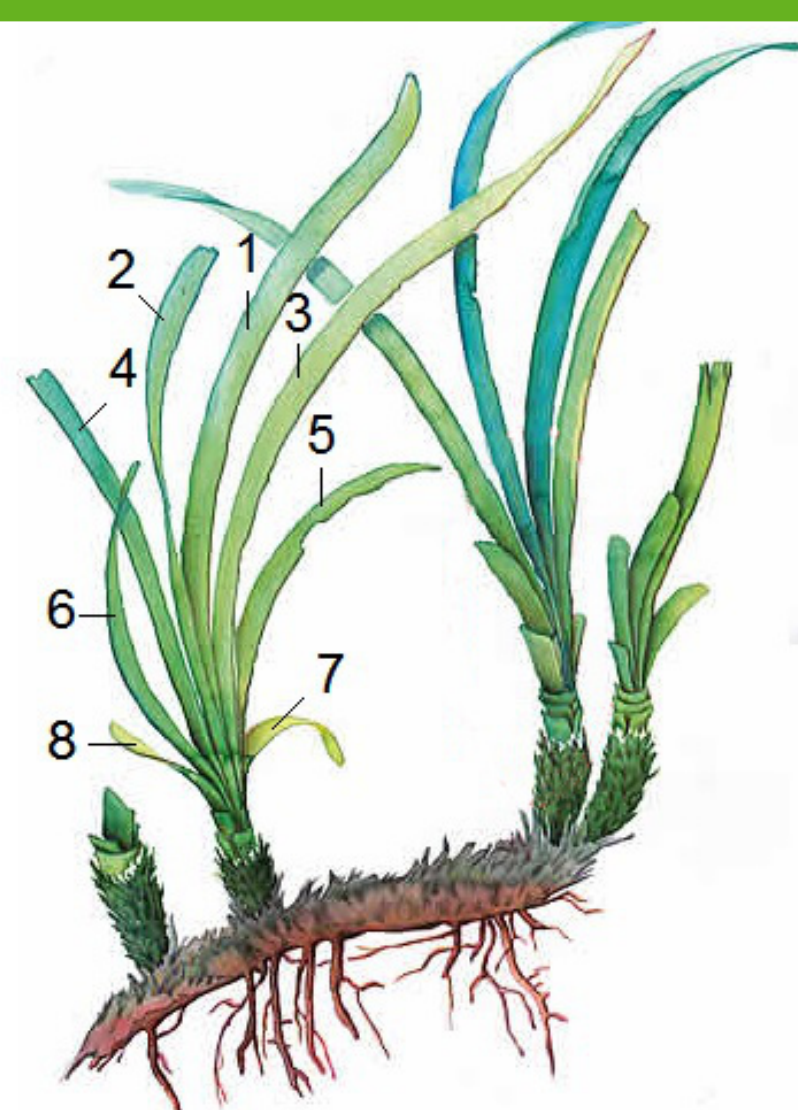


Fig. 1 Inner leaf is the number 1 and the rest of the leaves have correlative numbers according to their age.

MATERIAL AND METHODS

- Shoots were sampled in Bay of Calvi (Corsica, France) in June 2013.
- Mechanical traits: Tensiometer (Photo 1).
- C and N contents: EA-IRMS.
- Fiber content: Modification from Van Soest *et al.* (1991) protocol.



Photo 1 *P. oceanica* tested in a tensiometer (Instron).

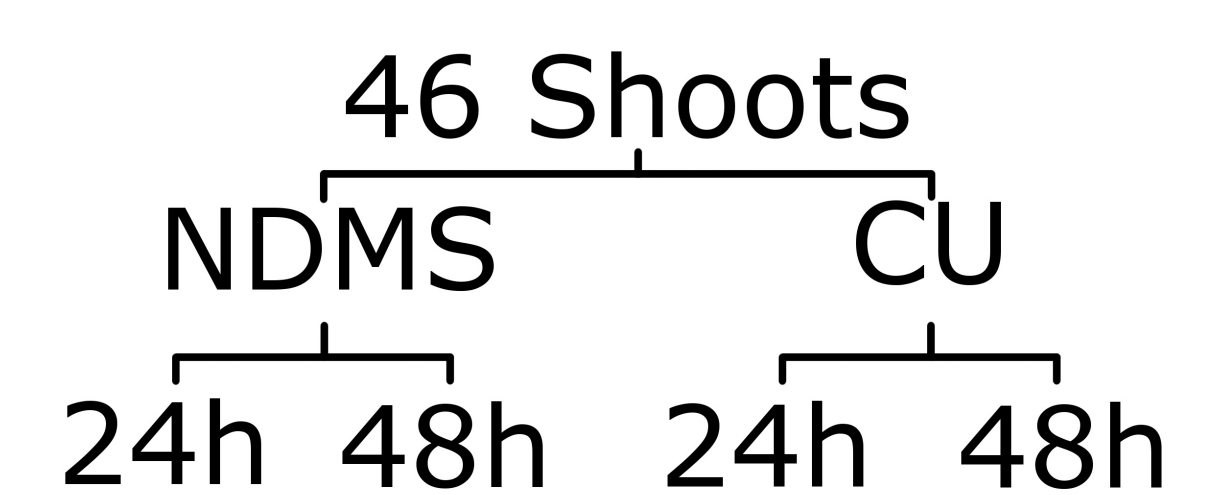
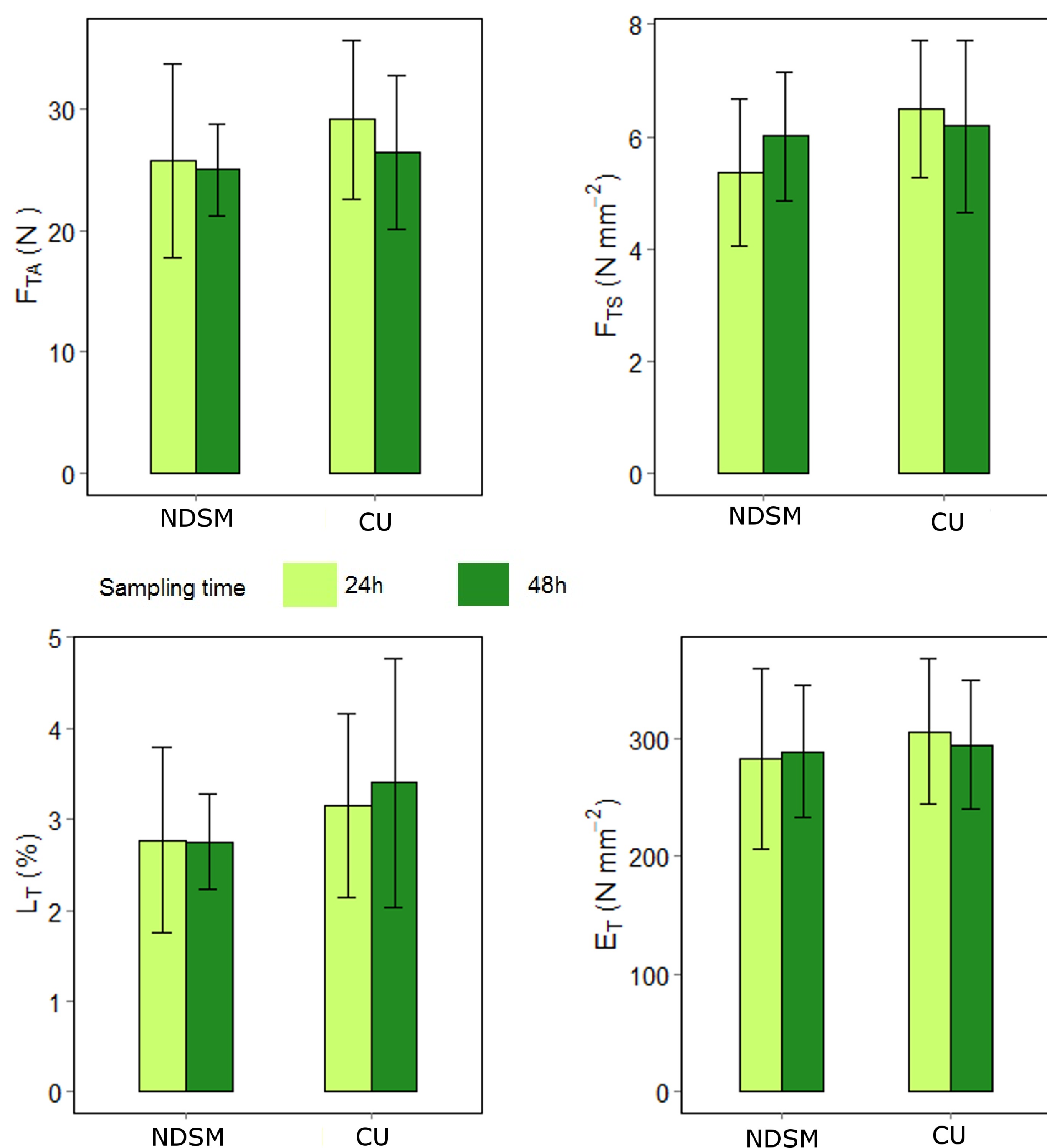


Fig. 2 Diagram of sampling design. **NDSM**: Non-Destructive Shoot Method (cutting the shoot without a portion of rhizome), **CU**: Classical Uprooted shoot.

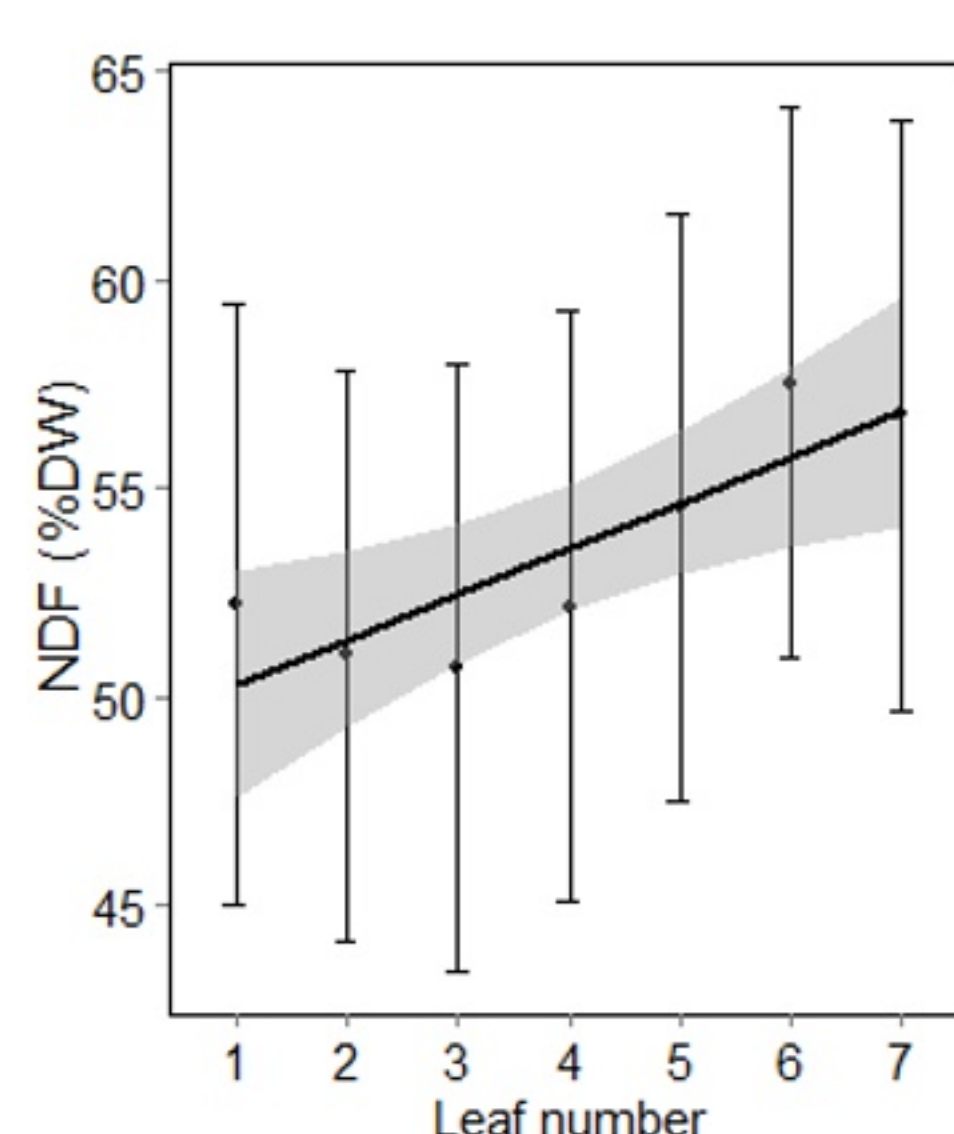
Effect of collection procedure on biomechanical properties



CU: classical uprooted. **F_{TA}**: breaking force, **F_{TS}**: breaking stress, **L_T**: elongation-to-tear, **E_T**: Young's modulus of elasticity. Values are means ± SD of replicates, considering leaf 4 and 5 of each shoot.

Patterns with leaf age

Nutrition-related properties



Yonger → Older

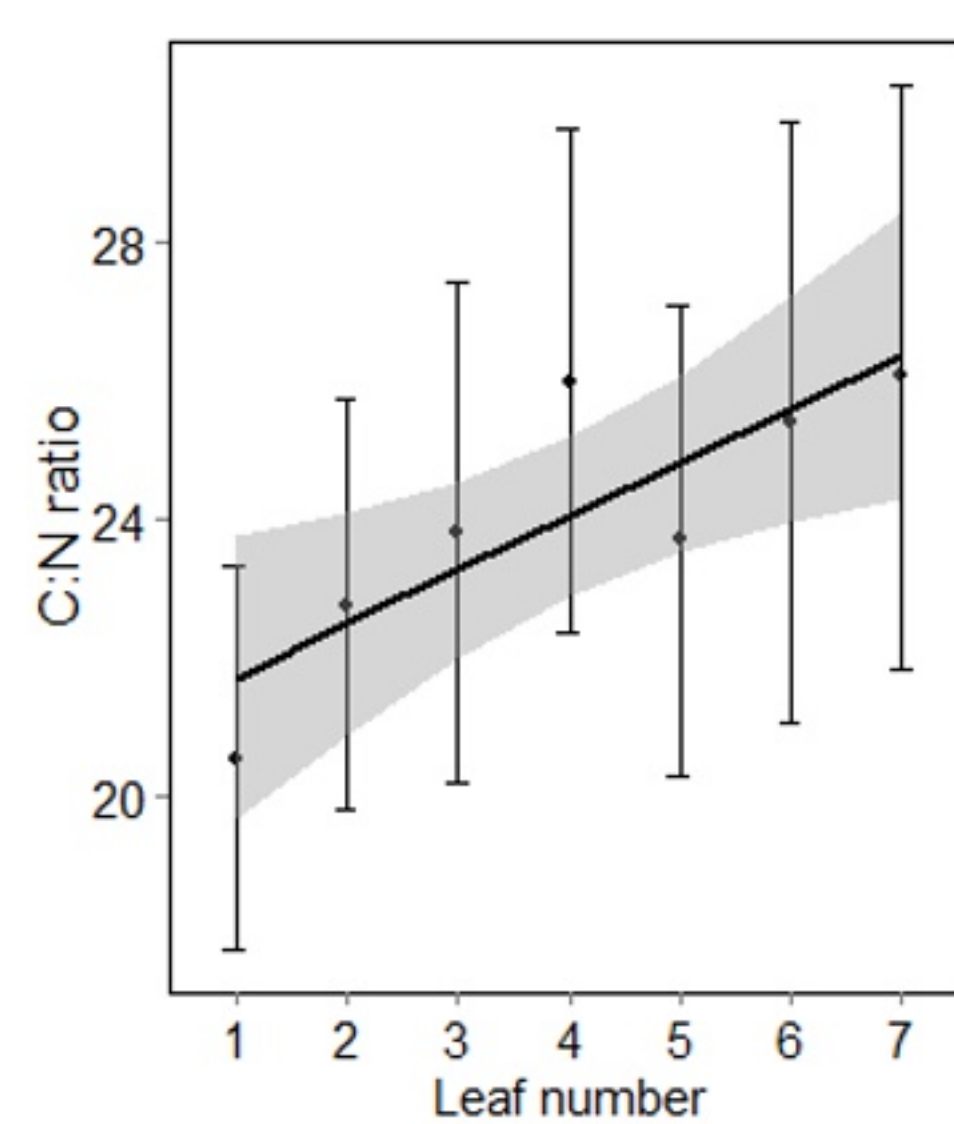
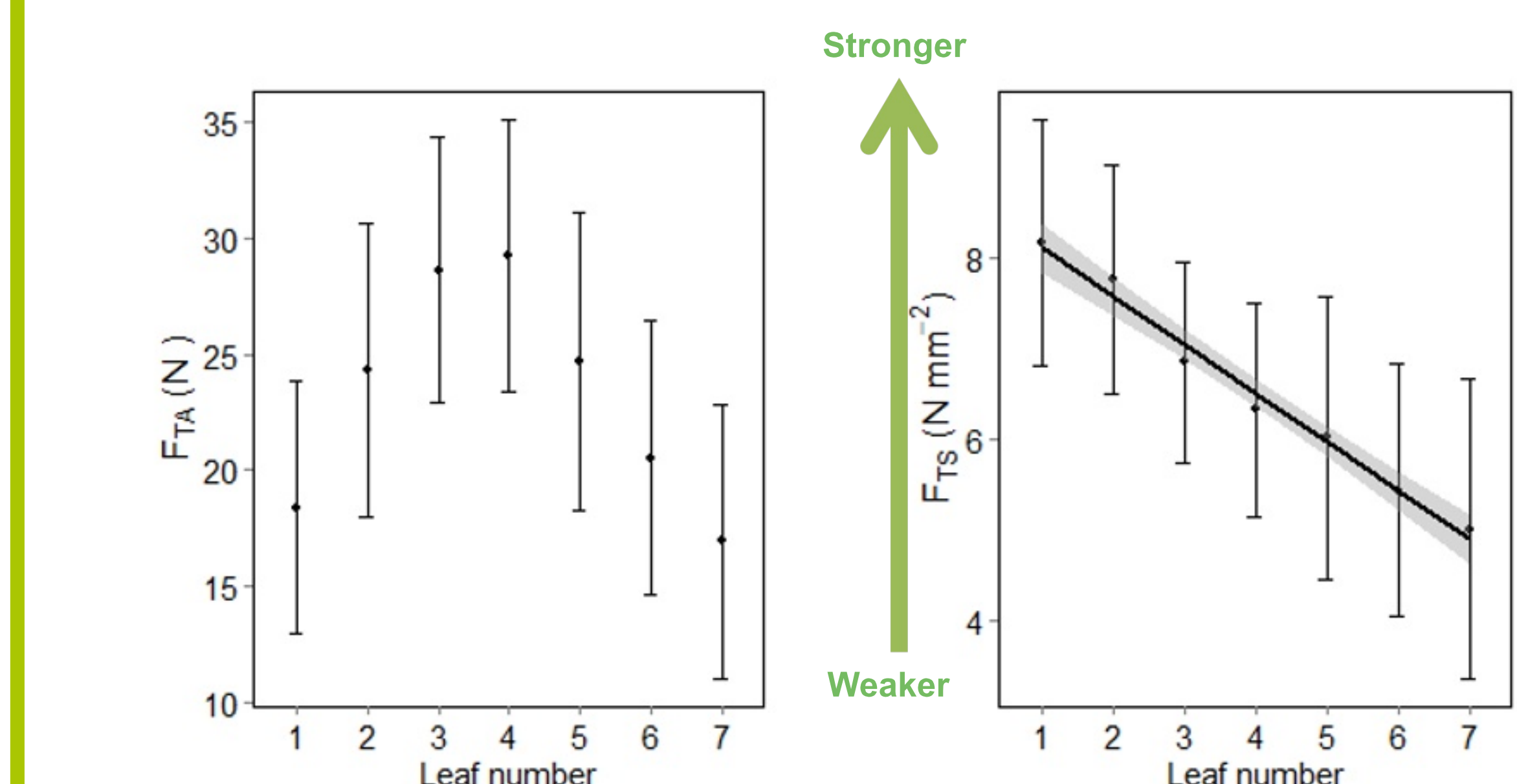


Fig. 4 **NDF**: leaf neutral detergent fiber content, **C:N ratio**. Values are means ± SD of replicates.

Biomechanical properties



Yonger → Older

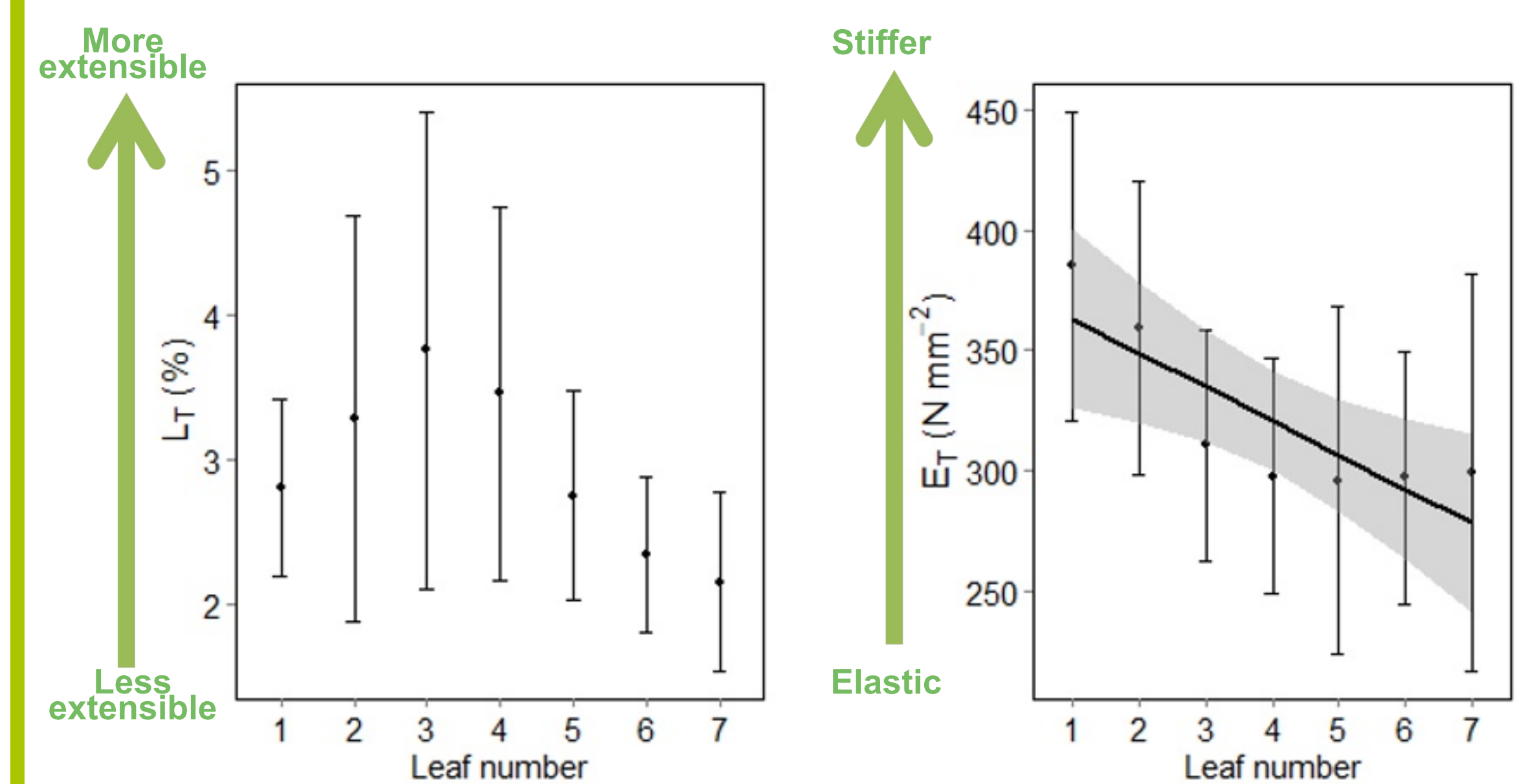


Fig. 5 **F_{TA}**: breaking force, **F_{TS}**: breaking stress, **L_T**: elongation-to-tear, **E_T**: young's modulus of elasticity. Values are means ± SD of replicates.

RESULTS AND DISCUSSION

- Sampling with a NDSM (measuring both within 24 - 48h) did not compromise the research objective of measuring mechanical leaf traits (Fig. 3).
- A clear intra-shoot pattern was obtained, with younger leaves having i) higher nitrogen content, ii) lower C:N ratio, and iii) lower fiber content (Fig.4).
- Leaf-mechanical properties also showed a clear intra-shoot pattern (Fig. 5). Breaking force and extensibility displayed a bell-shaped pattern, with intermediate leaves bearing higher forces and being more extensible. Stiffness and strength (force per cross-section area) decreased from young to old leaves.

CONCLUSION

The combined intra-shoot variability in mechanical and nutritional properties that we show here could explain herbivory patterns in *P. oceanica* leaves.

References: Van Soest PJ, Robertson JB, Lewis BA (1991) Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. Journal of dairy science 74: 3583-3597