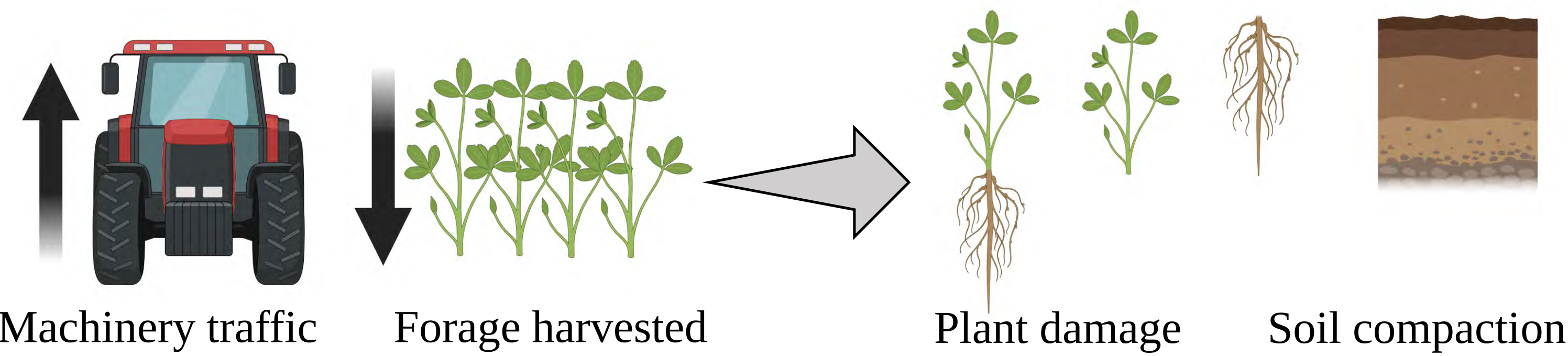




Motivation

Traffic can reduce production

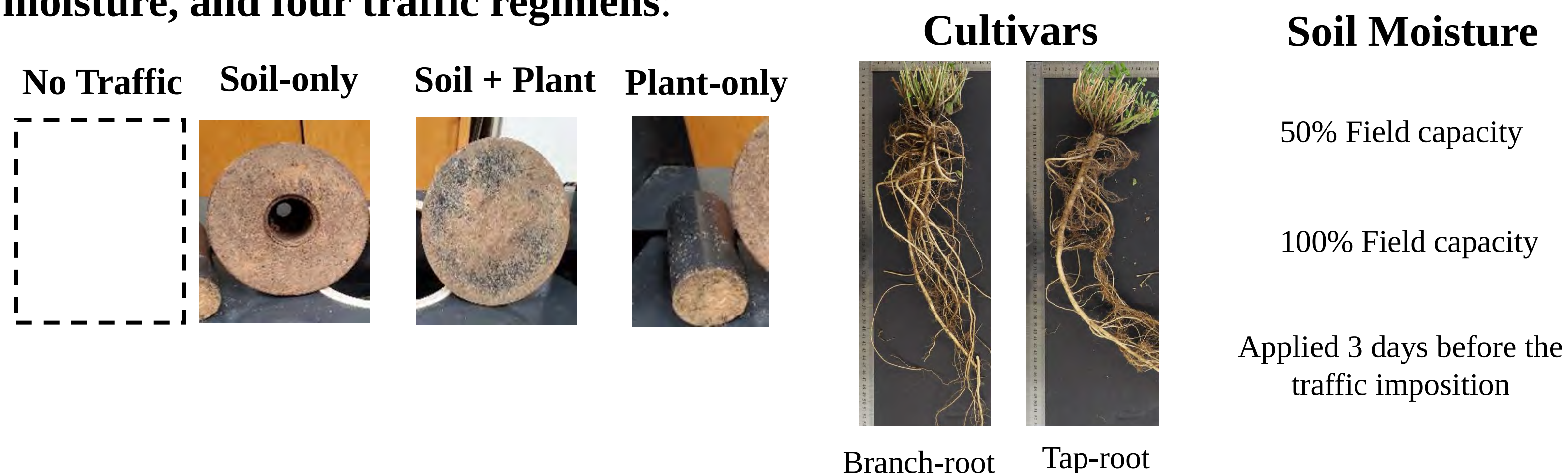


Objective

This study aims to evaluate the responses of two closely related alfalfa cultivars with contrasting root architectures (Branched vs. Tap Rooted) to simulated traffic under two soil moisture conditions (50 and 100% field capacity, FC).

Material and Methods

A greenhouse experiment was conducted using a factorial arrangement of **cultivars**, **soil moisture**, and **four traffic regimens**:



Soil collection and column preparation: Field soil; Collected by depth: 0-15, 15-30, 30-55 cm; Packed at the PVC column by depth; According to the field bulk density, by depth every ~5 cm

Planting: Alfalfa was seeded in the columns and allowed to grow for 60 days (1st harvest).

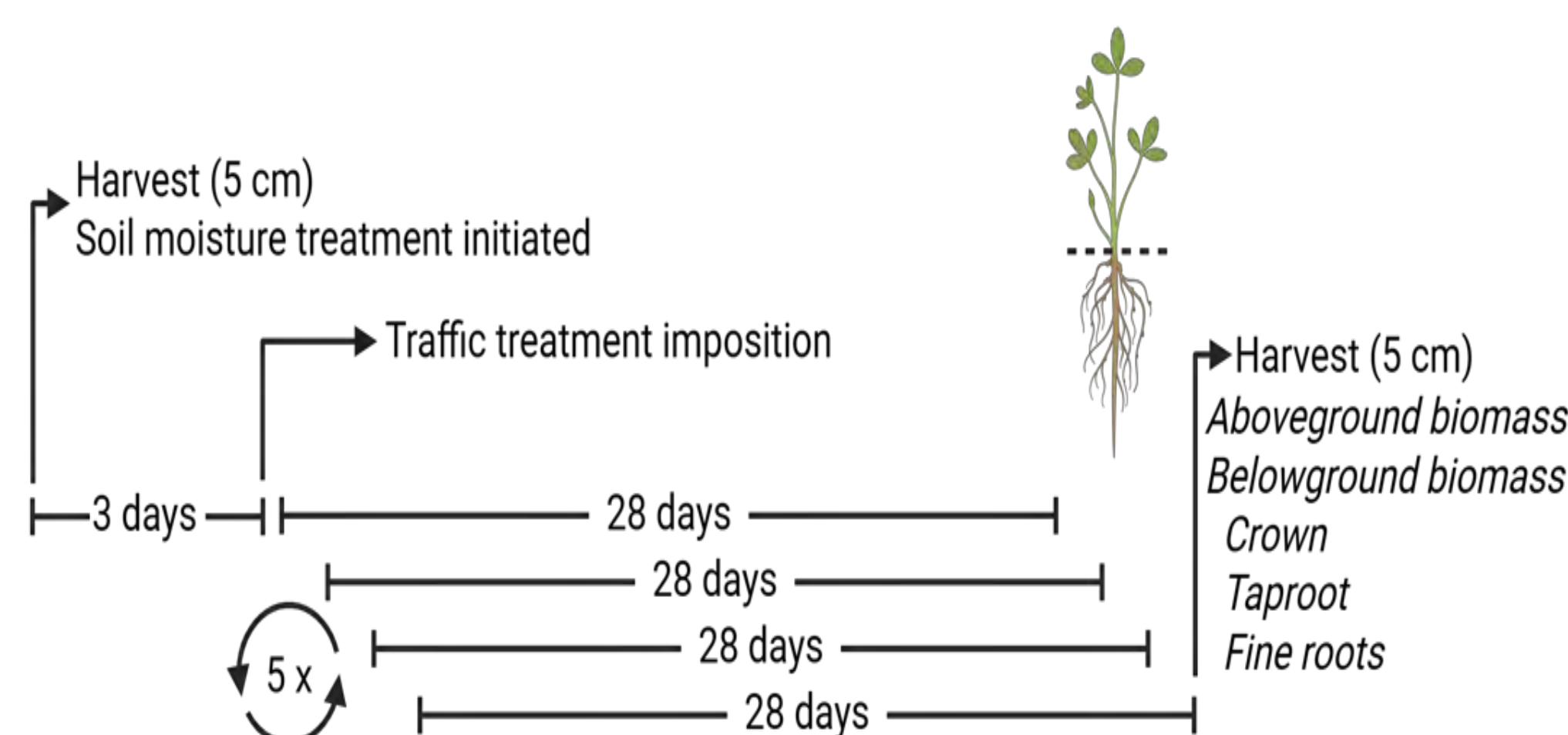


Figure 1. Treatment imposition and harvest schema

Traffic simulation: A traffic simulator applied pressure equivalent to that of agricultural machinery (200 psi) three days after harvest, simulating a hay operation, across four consecutive harvests.

- Pneumatic press
- 1.4 Mpa (N/m²) downforce (sensor at the base)
- 0.3 s
- Wheel traffic typical of agricultural equipment used for merging



Figure 2. Traffic simulator.

Results

50% Field capacity

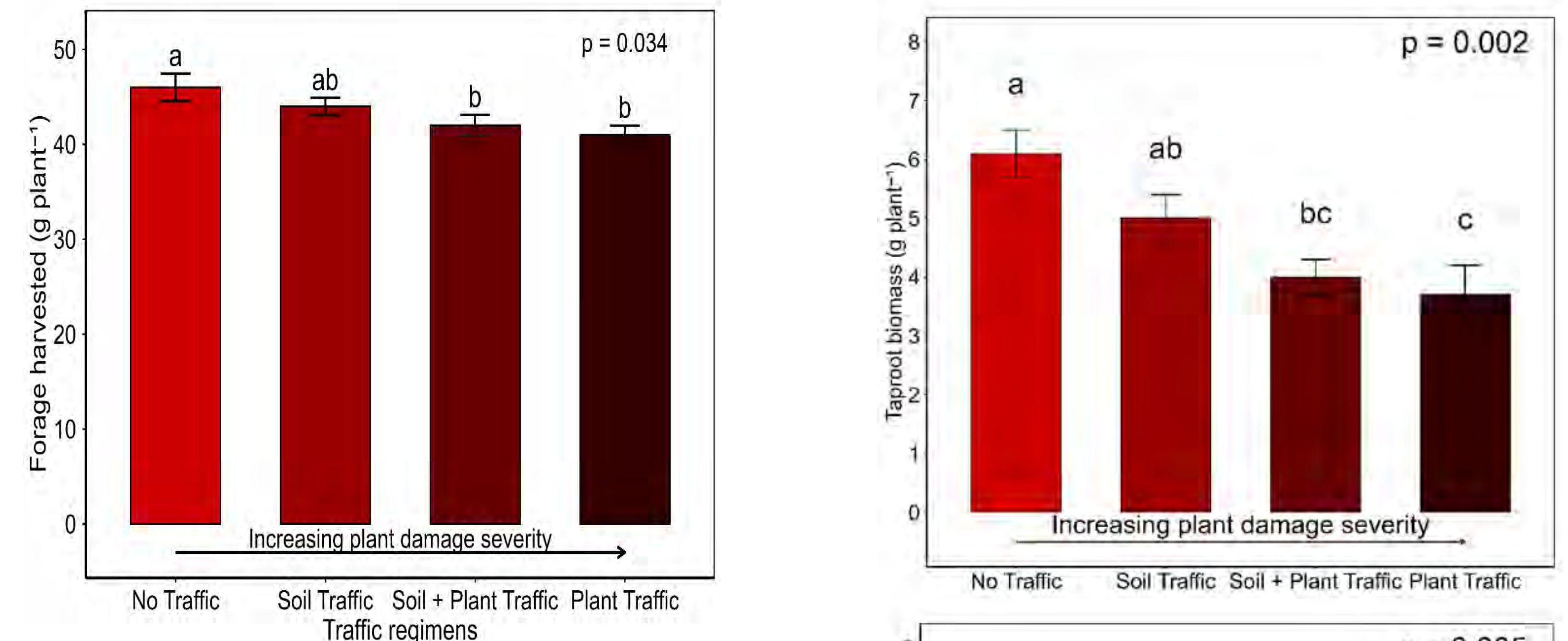
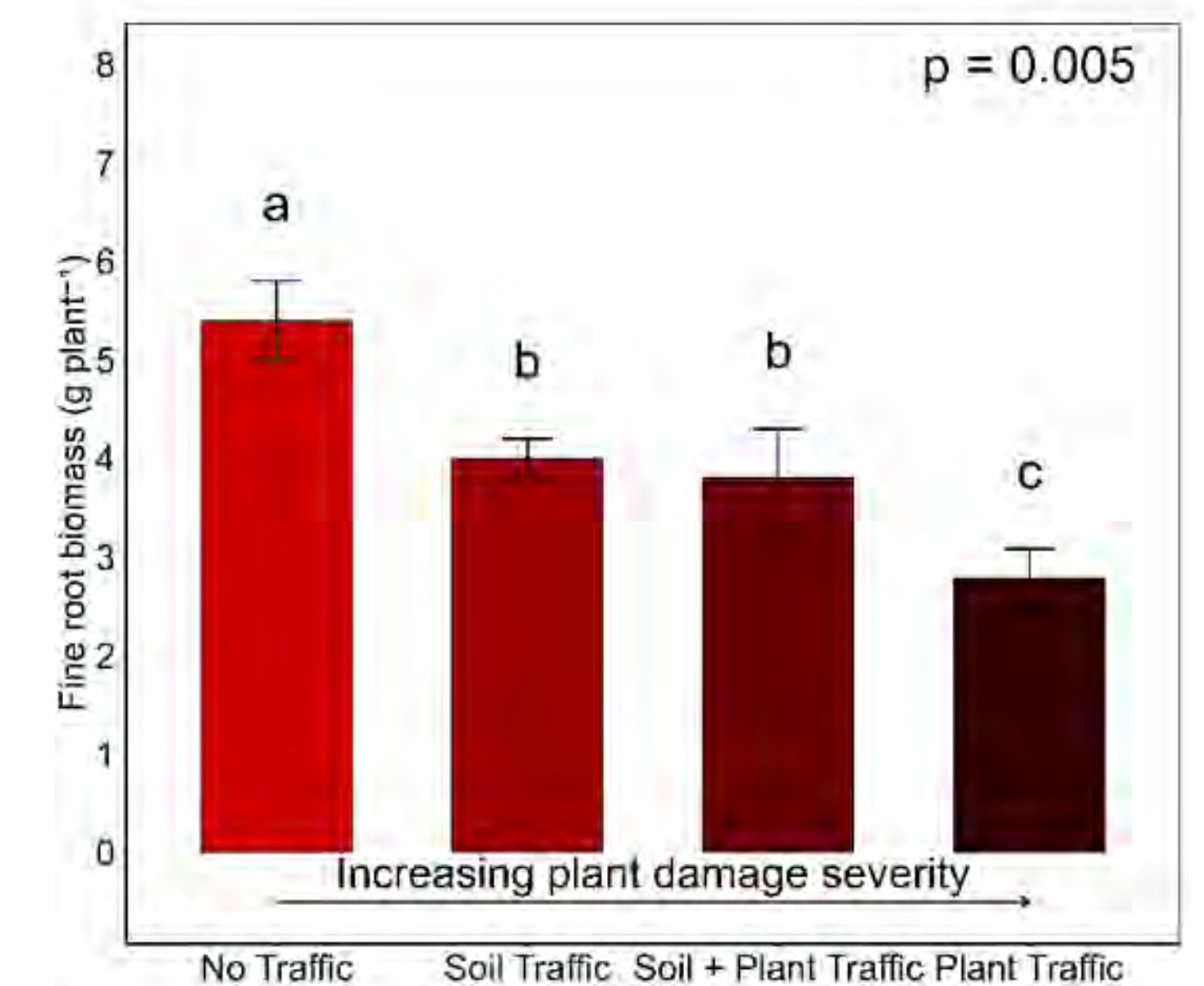


Figure 3. Effects of simulated traffic regimens on accumulated FH (4 harvests) at 50% field capacity soil moisture. Data are averaged between Branch Rooted and Tap Rooted alfalfa cultivars.

Figure 4. Effects of simulated traffic regimens on taproot and fine root biomass with soil moisture at 50% field capacity soil moisture. Data are averaged between Branch Rooted and Tap Rooted alfalfa cultivars.



100% Field capacity

Table 1. Effects of simulated traffic regimens on accumulated forage harvested (4 cuts) and taproot biomass at 100% field capacity soil moisture.

Traffic regimens	Forage harvested	Taproot biomass
	g plant ⁻¹	
No Traffic	49 a	4.0 a
Soil Traffic	42 ab	3.0 b
Soil + Plant Traffic	46 ab	3.4 ab
Plant Traffic	34 b	3.0 b
SE ¹	3.60	0.41
p-value	0.016	0.033

¹ SE = standard error of the mean

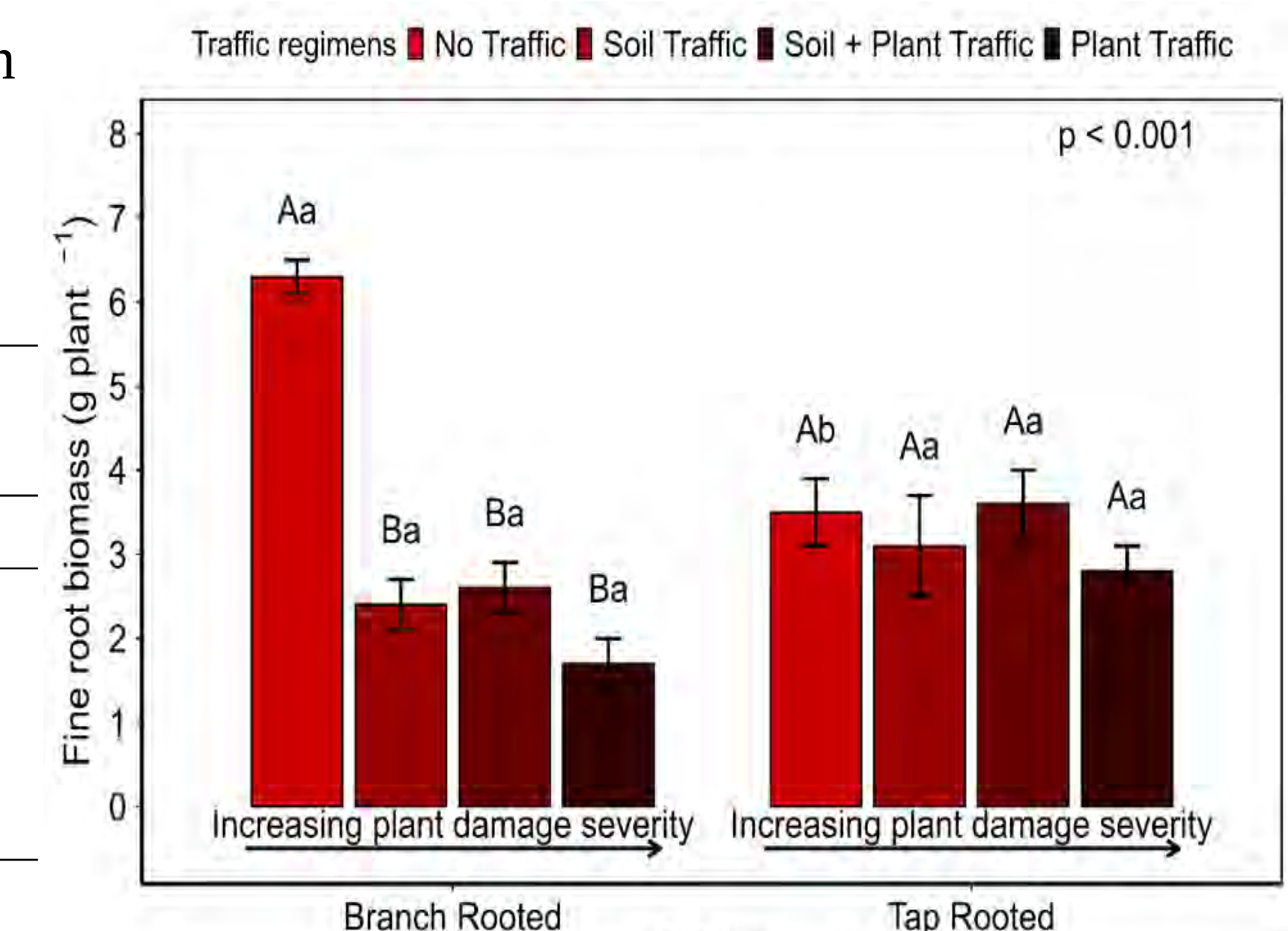


Figure 5. Effect of simulated traffic regimens and alfalfa cultivar on fine root biomass at 100% field capacity soil moisture.

Conclusions

- ❖ Direct plant damage had stronger effects on biomass production than those affecting only the soil.
- ❖ Simulated harvest-related machinery traffic reduces above- and belowground biomass in alfalfa, with responses depending on the severity of plant damage, cultivar root architecture, and soil moisture conditions.
- ❖ These findings highlight the role of cultivar root architecture in mediating plant responses to mechanical disturbance.

Acknowledgements

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