

Soil Penetration Resistance Influenced by Eucalypt Straw Management under Mechanized Harvesting

Judyson de M. Oliveira ^{1,2,*}, Cássio A. Tormena ², Gerson R. dos Santos ³, Lincoln Zotarelli ¹, Raphael B. A. Fernandes ⁴ and Teógenes S. de Oliveira ⁴

¹ Horticulture Science Department, University of Florida/IFAS, 2550 Hull Rd, Gainesville, FL 32611, USA; lzota@ufl.edu

² Agronomy Department, State University of Maringá, Av. Colombo, n 5790, Maringá 87020-900, PR, Brazil; cassiotormena@gmail.com

³ Department of Statistics, Federal University of Viçosa, Av. Peter Henry Rolfs, s/n, Viçosa 36570-900, MG, Brazil; gerson.santos@ufv.br

⁴ Department of Soils, Federal University of Viçosa, Av. Peter Henry Rolfs, s/n, Viçosa 36570-900, MG, Brazil; raphael@ufv.br (R.B.A.F.); teo@ufv.br (T.S.d.O.)

* Correspondence: judyson.dematoso@ufl.edu or judyson.matos@hotmail.com

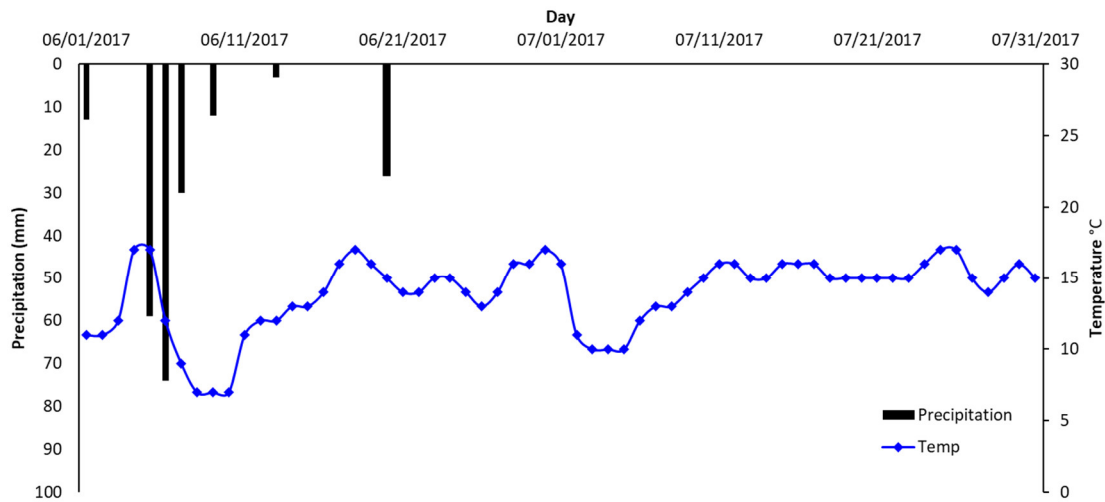


Figure S1. Precipitation and temperature between June 01 and July 31, 2017, measured by the nearest (38 km) weather station from the experimental areas. The weather station belongs to the National Institute of Meteorology (INMET), located in Ventania, Parana, Brazil, lat: -24.28027777; long: -50.21027777; level: 1093.41 m. Data are available on the INMET website: <https://bdmep.inmet.gov.br/> (accessed 27 May 2022).

Table S1. Particle-size distribution at the 0–0.20, 0.20–0.40, and 0.40–0.60 m layers in eucalypt cultivation areas under coppicing and stand renewal with different straw levels (100, 50 and 0%) both harvested by harvester + forwarder and feller + skidder systems.

Layers	Clay				Silt				Fine Sand				Coarse Sand			
	Average σ_s	CV σ_s	PR = f(Clay) δ		Average CV	PR = f(Silt)		Average CV	PR = f(Fine)		Average CV	PR = f(Coarse)				
(m)	kg kg ⁻¹	%	R	(m)	kg kg ⁻¹	%	R	(m)	kg kg ⁻¹	%	R	(m)	kg kg ⁻¹	%	R	<i>p</i> -Value
Coppicing areas																
harvester + forwarder																
0.00–0.20	0.28±0.09	32.6 0	0.290	0.11	0.08±0.04	47.1 6	0.146	0.44	0.34±0.05	13.4 2	–0.209	0.27	0.30±0.08	25.5 2	–0.354	0.07
0.20–0.40	0.31±0.10	31.4 3			0.09±0.04	48.7 8			0.33±0.05	15.6 1			0.27±0.07	24.2 6		
0.40–0.60	0.33±0.11	32.2 4			0.09±0.05	53.6 9			0.32±0.05	15.7 1			0.26±0.07	27.2 5		
feller + skidder																
0.00–0.20	0.19±0.07	37.5 3	–0.064	0.74	0.11±0.02	18.2 5	–0.28 0	0.13	0.37±0.03	8.09 3	0.211	0.26	0.33±0.06	17.4 7	0.058	0.76
0.20–0.40	0.23±0.06	27.7 9			0.12±0.02	14.3 5			0.36±0.04	9.81 4			0.29±0.04	12.9 9		
0.40–0.60	0.25±0.07	25.6 0			0.13±0.02	14.3 6			0.35±0.05	13.6 7			0.27±0.03	9.56 3		
Stand renewal areas																
harvester + forwarder with straw level 100%																
0.00–0.20	0.42±0.10	23.6 5	0.320	0.06	0.09±0.03	35.5 2	–0.00 8	0.96	0.26±0.08	31.3 8	–0.314	0.06	0.23±0.08	34.9 8	–0.148	0.39
0.20–0.40	0.44±0.09	19.6 0			0.08±0.03	34.7 8			0.25±0.06	23.5 3			0.23±0.07	30.5 4		
0.40–0.60	0.43±0.09	21.3 0			0.11±0.04	40.7 8			0.24±0.07	30.7 0			0.23±0.08	34.8 2		
harvester + forwarder with straw level 50%																
0.00–0.20	0.23±0.06	25.3 5	0.117	0.52	0.10±0.03	33.9 1	–0.19 2	0.28	0.37±0.04	11.3 4	0.148	0.41	0.30±0.06	20.9 6	–0.122	0.50
0.20–0.40	0.24±0.07	30.0 7			0.11±0.04	34.8 2			0.36±0.05	13.5 5			0.29±0.07	24.0 6		
0.40–0.60	0.26±0.05	18.9 6			0.12±0.05	38.8 7			0.34±0.05	15.4 0			0.29±0.07	25.7 2		
harvester + forwarder with straw level 0%																
0.00–0.20	0.18±0.03	16.5 6	0.231	0.20	0.11±0.03	27.4 3	–0.06 0	0.74	0.44±0.03	7.01 3	–0.267	0.13	0.26±0.04	16.2 8	–0.002	0.99
0.20–0.40	0.21±0.02	11.5 2			0.09±0.03	36.1 4			0.43±0.03	6.29 3			0.27±0.05	19.4 6		
0.40–0.60	0.24±0.02	7.47			0.10±0.04	34.3 2			0.41±0.05	11.7 1			0.25±0.06	22.4 4		
feller + skidder with straw level 100%																
0.00–0.20	0.38±0.04	10.3 5	–0.049	0.78	0.03±0.02	72.4 7	–0.04 1	0.81	0.32±0.03	9.55 3	–0.163	0.34	0.27±0.03	11.6 9	0.194	0.26
0.20–0.40	0.40±0.03	8.48			0.04±0.03	76.3 5			0.31±0.03	8.84 3			0.24±0.03	12.8 8		
0.40–0.60	0.44±0.03	7.42			0.03±0.03	94.7 2			0.30±0.03	8.67 3			0.23±0.03	12.6 8		
feller + skidder with straw level 50%																

0.00– 0.20	0.35±0.05 3	14.4 3	0.477	0.00	0.05±0.0 3	59.1 2	0.185	0.30	0.26±0.0 6	22.4 5	–0.278	0.12	0.33±0.0 7	19.9 4	–0.329	0.06
0.20– 0.40	0.38±0.05 9	12.4 9			0.05±0.0 3	68.3 9			0.27±0.0 5	17.8 9			0.30±0.0 5	15.2 0		
0.40– 0.60	0.41±0.04 4	10.5 4			0.06±0.0 4	64.9 8			0.24±0.0 5	22.3 5			0.29±0.0 5	16.9 6		
feller + skidder with straw level 0%																
0.00– 0.20	0.30±0.04 2	13.3 2	0.286	0.11	0.11±0.0 4	34.2 9	–0.35 3	0.04	0.24±0.0 3	13.3 1	–0.226	0.21	0.35±0.0 6	15.8 4	0.194	0.26
0.20– 0.40	0.31±0.04 4	11.5 4			0.13±0.0 2	18.8 5			0.23±0.0 3	11.5 5			0.32±0.0 4	12.8 1		
0.40– 0.60	0.34±0.05 7	15.4 7			0.12±0.0 3	25.8 9			0.22±0.0 4	16.9 8			0.33±0.0 5	14.4 4		

[§] Average ± confidence interval (90% of confidence); [§] Coefficient of variation (CV);

[§] Indexes of the correlation between penetration resistance (PR) and soil particle fraction (clay, silt, fine sand, and coarse sand) in the 0–0.60 m soil depth layer: Coefficient of linear correlation (R) and Student's *t*-test, where: (*) significant at *p* < 0.05 and (ns) not significant.