



Cool-Season Mixed Pasture Growth and Root Density Under Differing Defoliation Regimes and Leaf Area Indices

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Introduction and objectives. Growth of cool-season perennial pasture species varies with timing and severity of defoliation. Short-term differences in root density may serve as an index of longer-term trends in soil organic matter. We hypothesized that root density, but not total seasonal herbage dry matter (DM) production, may be greater for relatively few harvests of late-maturity pasture at leaf area index (LAI) ≥ 8 than for more frequent harvests at LAI $\leq 5-6$. We compared LAI, herbage mass, and root density of cool-season perennial mixed-species pastures under a range of common defoliation regimes.

Methods. Silt loam soils at the WVU Reedsville Experiment Farm in northern WV (530 m elevation; 39° 30' N, 79° 50' W) supporting orchardgrass (*Dactylis glomerata*), tall fescue (*Schedonorus arundinaceus*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), smooth bromegrass (*Bromus inermis*), red (*Trifolium pratense*) and white clover (*T. repens*), and narrow- (*Plantago lanceolata*) and broadleaved plantain (*P. major*) were sampled throughout growing seasons of 2012-2013 according to treatments in Tables 1-2.

Whole plots in three blocks were clipped twice to 3-4 cm residual height during April to simulate severe continuous stocking, or were protected from early defoliation (Table 2). Herbage mass was estimated with a calibrated rising plate meter and LAI was estimated from canopy light interception via line quantum sensor (Decagon AccuPAR LP-80) immediately prior to defoliation. Cores to a 15-cm depth were sectioned into horizons 2.5 cm thick x 7.6 cm in diameter (Fig. 1e). Roots were separated by washing samples through a series of sieves with a final aperture of 0.3 mm, dried to constant weight at 60° C, and expressed as weight proportions of dry samples.

Results and Conclusions. Root density ranged 0.01-1.03 g/100 g soil, averaged 0.14 g/100 g soil, and decreased with sampling depth. There was an inconsistent impact of early-spring defoliation or protection on roots, herbage production, and LAI. Clipping treatments had little to moderate impact on roots, but major impact on LAI and forage

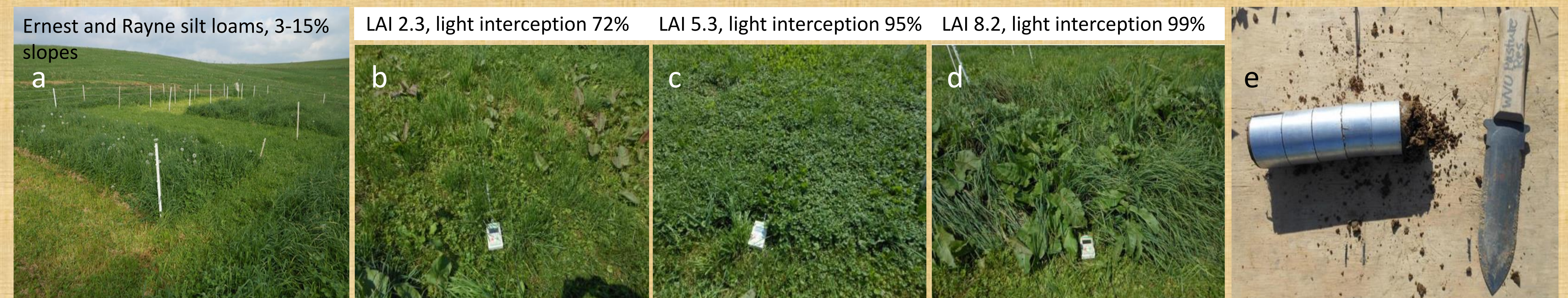
production, which were strongly associated. Clipping may not have been severe enough to separate treatment effects, and greater differences might be expected for more defoliation-sensitive species. Under weekly clipping, species shifted toward ground ivy (*Glechoma hederacea*). Findings did not confirm our hypotheses. Samples retained for near-infrared reflectance spectroscopic determination of root density in pulverized and intact cores suggest that this may be an effective technique.

Table 1. Subplot defoliation treatments.

Treatment and defoliation management
A Weekly to 10 cm height
B Growth to 25-30 cm height, then cut to 6 cm
C Growth to 25-30 cm height, then cut to 10 cm
D Growth to mature (hay) stage, then cut to 10 cm

Table 2. Whole plot treatments, dates, and number of cuts.

Treatments 2014	Harvest dates range	No. cuttings
A clipped early spring	5/20 – 10/24	20
A protected	5/1 – 10/24	22
B clipped early spring	6/5 – 10/8	5
B protected	5/20 – 10/24	6
C clipped early spring	6/5 – 10/8	5
C protected	5/20 – 10/24	6
D clipped early spring	6/5 – 10/24	4
D protected	6/5 – 10/24	4



Figures 1a-e. Overview of one block, examples of LAI and light interception, and collection of soil core horizons.

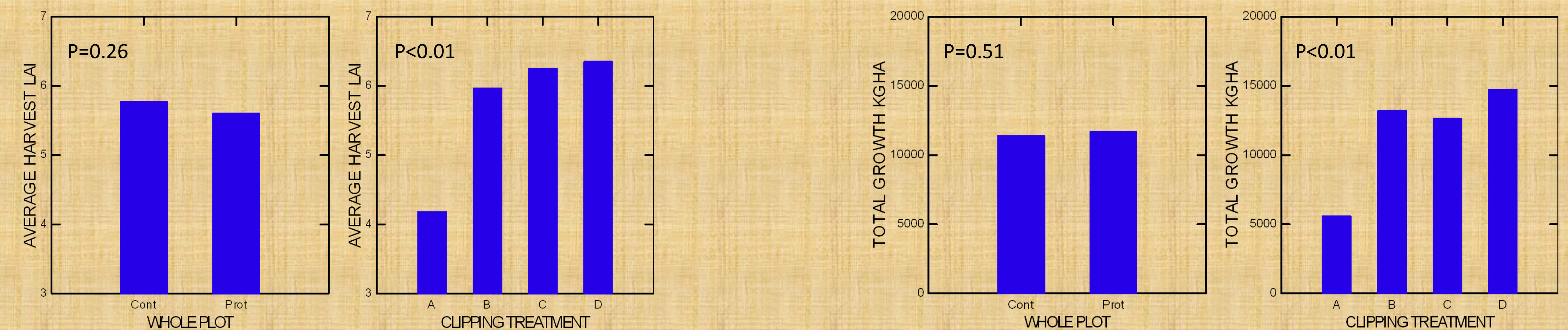
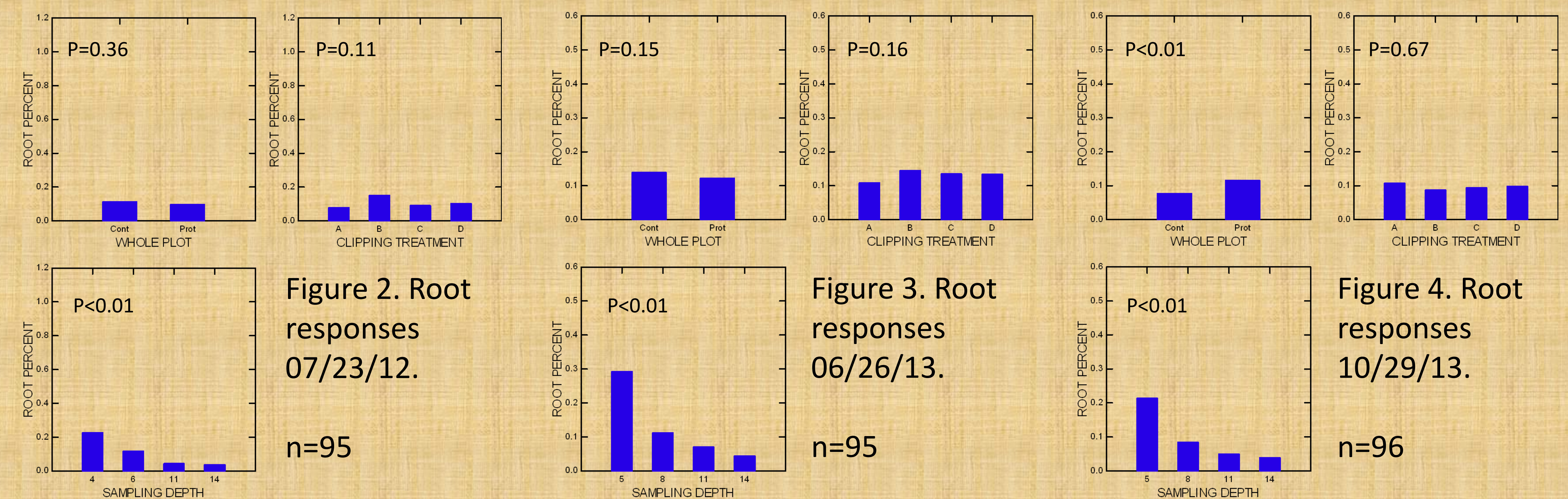


Figure 5. Season-mean harvest LAI 2014, n=4-22.

Figure 6. Total-season herbage production 2014, n=4-22.

