

## Effects of tree and tillage systems on the productivity of the herbaceous stratum in silvopastoral systems in the southwest of Córdoba, Argentina

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**Introduction** In the southwest of Córdoba, Argentina, there are lands with severe water erosion, due to the interaction of rolling pampas, high intensity precipitation, loam soil, and farming systems based on annual crops (Cantero *et al.*, 1998). In an attempt to mitigate the erosive processes, a silvopastoral system was established in which winter forage was combined with trees. To improve the physical condition of the soil, two tillage systems were implemented. The objective of this paper was to determine the effect of trees and tillage systems on the production of forage.

**Materials and methods** A silvopastoral system with two different tree species was established in a split plot experiment with two replicates in 1998. The system included a double row of trees planted at each side of an “alley” of 21 m. The species of trees were *Pinus elliottii* and *Eucalyptus viminalis*. The forage was *Avena sativa* in 2003. Two systems of reduced tillage, one superficial and the other deep, were used. To estimate the forage biomass, plots were established at two distances from the trees (2 and 10.5 m) and one plot without trees, adapting the method of Acuña *et al.* (1984). A sample of four observations of forage biomass was taken from each replicate at the end of the cropping cycle in 2003. Data were analysed by ANOVA.

**Results** The forage biomass associated with the arboreal species is shown in Table 1 and the biomass associated with tillage treatments in Table 2. The forage biomass production was significantly superior ( $p<0.05$ ) when forage grew in the “alley” associated with *Pinus elliottii*, than when it grew in the plot either associated with *Eucalyptus viminalis* or without trees. The forage production with deep tillage was significantly higher ( $p<0.05$ ) than that with superficial tillage. These findings suggest that the water evaporation rate in the “alley” was lower than that in the plot without trees. However, in the “alley” with *Eucalyptus* the forage biomass close to the tree was significantly lower, possibly due to the effect of allelopathy. A greater level of root exploration was observed in the deep tillage treatment, which made it possible for *Avena sativa* to have a greater quantity of water for biomass production.

**Table 1** Forage biomass in different planting treatments

Treatments	Forage biomass (kg/ha)
<i>Pinus elliottii</i>	1912 a
<i>Eucalyptus viminalis</i>	1079 b
Field without trees	1262 b

**Table 2** Forage biomass in different tillage treatments

Treatments	Forage biomass (kg/ha)
Reduced deep tillage	1578 a
Reduced superficial tillage	1258 b

Values followed by the same letter do not differ significantly by the Fisher (LSD) test at  $p<0.05$

**Conclusions** The forage biomass production was superior in the plots with deep tillage and with *Pinus elliottii* in the fifth year of the experiment. However, it should be noted that the wood biomass has not been assessed, but this is part of the future research agenda

### References

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