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Defoliation impact on the above and belowground productivity of *Festuca arundinaceae* Schreb

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Introduction

The main objective of pasture management is to maximize plant productivity and ensure sustainable animal performance, without inducing pasture deterioration. Many researchers indicated that plant survival and sustainable production is a function of seedbed preparation, irrigation and defoliation, with defoliation having the largest impact on plant persistence (Fulkerson and Donaghy, 2001). The net effect of defoliation (degree of intensity and frequency) can therefore either be beneficial or detrimental to survival and productivity of a pasture. The aim of this study was to quantify the impact of different intensities and frequencies of defoliation on above- and belowground phytomass production of the cultivated pasture *Festuca arundinaceae* Schreb. under irrigation.

Materials and Methods

The study on *Festuca arundinaceae* (tall fescue, cultivar Festal) was conducted in the green house in cylindrical pots of a 540 mm depth and 210 mm diameter (volume of 0.019 m^3). The pots were made of nutec fiber cement, with three holes (15 mm) at the bottom of each pot to prevent water logging. Each pot were first filled with 1 g gravel with a size of approximately 10 x 10 mm. Soil (sandy-loam) was packed in portions of 2.5 kg pot^{-1} (to remove as much air as possible) on top of the gravel, to a total of 27.5 kg pot^{-1} . After adding each soil portion, the soil was slightly tramped with a small wooden pole to ensure a firm bulk density. The soil-water content was kept between field water capacity (FWC) and permanent wilting point (PWP), the so called plant available water. The soil was dried out before filling the pots, after which the pot weight was taken as PWP. The FWC was determined after saturated the dry soil with water and left for 48 hours before being weighted. *Festuca arundinaceae* was planted in each pot and left for six weeks to establish before applying the different defoliation treatments. Respective day and night temperatures of 25-30^{0}C and 15-18^{0}C were maintained in the green house. The defoliation treatments included: A = weekly defoliation at 20 mm height (from soil level), B = weekly defoliation at 40 mm height, C = weekly defoliation at 80 mm height, D = defoliation every second week at 40 mm height and K = control, defoliated at beginning and after eight weeks at 40 mm height. Each treatment was replicated in 10 pots. The aboveground phytomass were obtained by cutting all plants at the different defoliation dates, while the roots were washed from the soil at the end of the trial (after eight weeks) through a 1 mm mesh. All plant parts were oven dried at 75 ^{0}C before weighing. All data were analyzed by standard ANOVA at P=0.01.

Results and Discussion

The every second weeks defoliation showed a constant high aboveground phytomass production over the studied period, with still a production of 2.66 g $plant^{-1}$ eight weeks after the trial started (Fig. 1). By contrast, the weekly defoliations showed a very drastically decrease in aboveground phytomass productions already from week two, with only 0.02 g $plant^{-1}$ after nine weeks of defoliation. The weekly defoliation at 20 mm height had the greatest impact on aboveground phytomass production throughout the trail. The weekly defoliation at intensity of 40 mm height showed over the first four weeks of defoliation a relatively high production before collapsing. On the other hand, the aboveground production for the 80 mm defoliation height at a weekly interval, took more or less six weeks before a drastically decrease in production occurred.

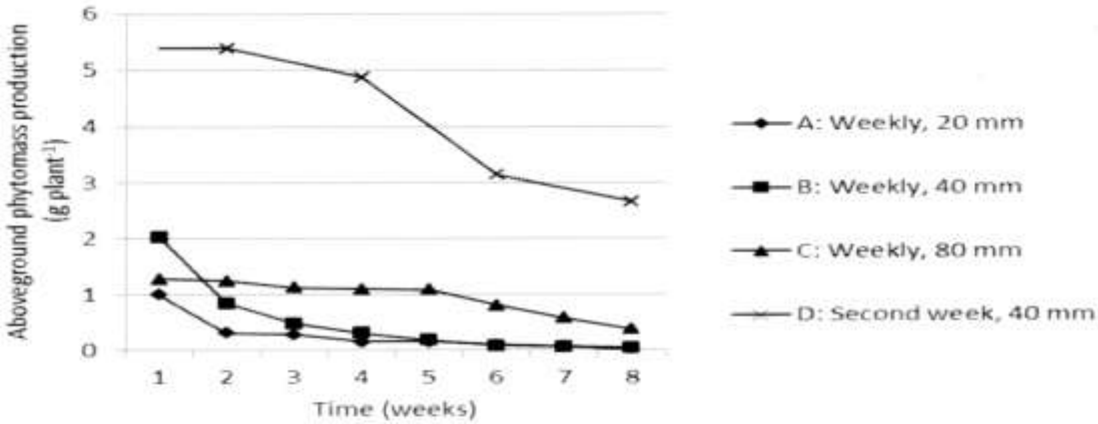

Figure 1: *Mean (n = 10) aboveground phytomass production (g plant^{-1}) for the different defoliation treatments over an eight week period.*

The every second weekly defoliation at 40 mm height showed the highest (P<0.01) total aboveground phytomass production, even higher (P>0.05) than that of the control where the plants were defoliated only once after eight weeks growth (Fig. 2). As expected, the lowest (P<0.01) aboveground phytomass were obtained from the weekly defoliation at 20 mm height. The same trend was found by other researchers on cultivated pastures that conservative intensities and frequencies of defoliation are important for sustainable plant production (Matches, 1966; Fulkerson and Donaghy, 2001). Both above- and belowground phytomass production decreased with an increase in intensity and frequency of defoliation. With the exception of the weekly defoliations at heights of 20 and 40 mm, the aboveground phytomass production was higher than that of the belowground phytomass. Root production were the highest (P<0.01) in the eight weeks defoliation frequency at a defoliation height of 40 mm.

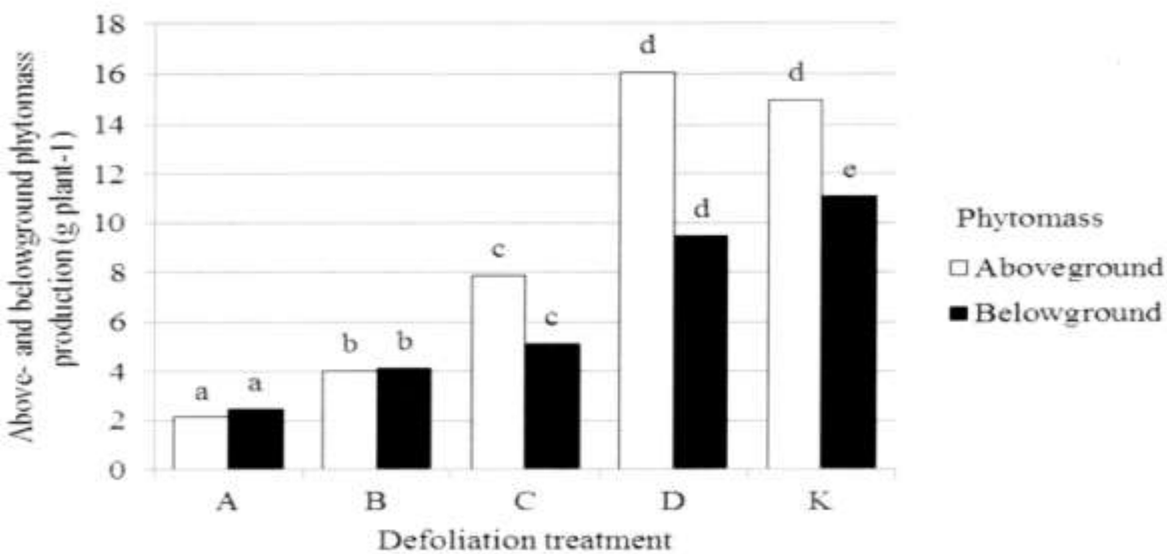

Figure 2: *Above- and belowground phytomass production (g plant^{-1}) for the different defoliation treatments over an eight week period. Means (n + 10) within above- or belowground components with different superscripts differ significantly (P < 0.01), based on Tukeys test. A = weekly at 20 mm, B = weekly at 40 mm, C = weekly at 80 mm, D = every second week at 40 mm and K = eight-weekly at 40 mm.*

Conclusion

It was clear that the more intense the defoliation, the sooner the drastically decrease in aboveground phytomass production occurred. The more frequent the defoliation and the higher the intensity the lower both above- and belowground phytomass production. The highest aboveground phytomass production were obtained from the less intense defoliation (40 mm height) every second week. On the other hand, a long resting period of at least eight weeks is needed for root recovery after defoliation.

References

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