Effect of defoliation on nutrient- induced differential root growth in *Poa annua*

森　彩由希（筑波大学 生物学類）　　指導教員：Irving, Louis（筑波大学 生命環境系）

Introduction

Nutrients such as N are essential for plant growth. However, they are distributed heterogeneously in the soil and are a major factor limiting biomass production. Therefore, plants have evolved mechanisms to maximize nutrient uptake and compete for limited resources. Differential root growth in nutrient- rich patches is an important mechanism in plant competition.

A previous experiment in our lab examined changes in growth, biomass allocation, leaf area, and SLA (specific leaf area) of *Poa annua* plants in response to light level, N supply, and N distribution (homogeneous vs heterogeneous). The results showed that when plants were grown under low light conditions, while their growth rates were reduced, their leaves become thinner and larger to increase their surface area for light interception. However, differential root growth was noted even under low light conditions, suggesting that by changing their leaf shape, the plants had created sufficient photosynthetic capacity to sustain root growth.

The aim of this experiment was to investigate whether differential root growth in *Poa annua* could be suppressed by defoliation. We hypothesized that differential root growth will be suppressed in defoliated *Poa annua* plants.

Materials and Methods

Poa annua plants were grown in a split- root box (Figure 1) which has a partition in the middle, dividing the box into two chambers. Half of the plants received N evenly between the two chambers with the allocation of 50/50, while other half of the plants received N unevenly with an allocation of 90/10. Within each group, half of the plants were undefoliated controls, while the other half were defoliated every six (experiment 1) or every two days (experiment 2) at the height of 50 mm from the ground. There were 12 replicates prepared for each treatment, meaning 48 replicates in total for each experiment.

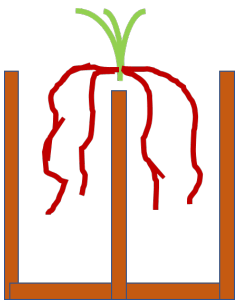

Figure 1. Root box design

Results and Discussion

In both intact and defoliated plants, no significant difference in root mass between the left and right chambers was seen under even N distribution, while significantly higher root mass was seen in the high- N side chambers when N was supplied unequally (Figure 2a). Since this significant difference in root growth was also found in the defoliated plants, the results showed that defoliation could not suppress differential root growth. Similarly, when defoliation intensity was increased to every two days, the patterns of the result remained unchanged from the first experiment, where plants were defoliated every six days. Even under the higher defoliation frequency, defoliation could not suppress differential root growth (Figure 2b).

However, the results showed that the total root mass of defoliated plants in experiment two (Fig 2b) was much lower than in experiment one (Fig 2a). Moreover, differences in root mass between chambers of defoliated plants were also much smaller in plants in experiment two than experiment one.

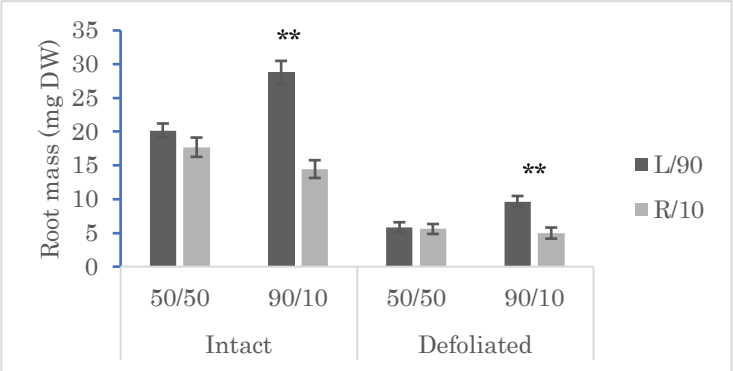

Figure 2a

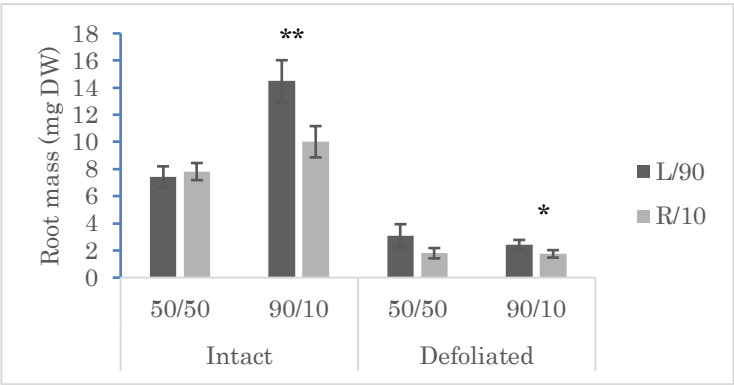

Figure 2b

Figure 2a&b: root mass of intact and defoliated *Poa annua* under even and uneven N distribution after 18 days of treatment (2a: defoliation every 6 days, 2b: defoliation every 2 days) (*=p<0.05, **=p<0.001).

Conclusion

Defoliation could not completely suppress differential root growth. Increase in defoliation intensity led to a greater decrease in root growth and weaker differential root growth.