Root development in perennial ryegrass under a range of cutting treatments

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Abstract

Perennial ryegrass plants were grown in tubes and subjected to a range of cutting regimes to simulate different grazing frequencies. Plants were allowed to develop after sowing and then cut to an average stubble length of 20mm. After cutting the plants were allowed to recover, uncut for a range of rest periods. The leaf and root growth was then compared with continual leaf removal for up to 76 days. A further treatment was for an initial cut to 20mm and then maintained at 20mm of stubble compared with a range of spell intervals and stubble and root weights compared. Plants continually cut short had roots only 8% the weight of roots from the uncut plants. Roots from plants allowed to recover for 46 days after close cutting were 24% of the weight of roots from uncut plants. Plants cut with up to a 30 day rest had only 54% root weight of those left uncut for up to 65 days.

Key Words

Ryegrass, cutting, roots, recovery.

Introduction

With the advent of more interest in time controlled grazing systems, the agronomy of the plant root system is frequently mentioned but rarely measured. A number of studies have looked at the regrowth of plant leaves under various cutting frequencies (1 and 2). Little emphasis has been placed on the effect of defoliation on root growth under sheep grazing regimes and the importance of recovery periods on maintaining root depth and volume in a soil profile to maintain access to nutrients and water. The current project investigated extreme levels of defoliation with a range of recovery patterns and how this affected root growth.

Materials and Methods

Jackaroo perennial ryegrass, (Lolium perenne) was sown to a depth of 10mm in 400mm deep 65mm diameter PVC tubes in a glasshouse at 21?C and four plants per tube were allowed to develop for 44 days before the first treatment. The plants were grown in sand with complete fertiliser slow release beads used to provide nutrients and a complete plant feed with micronutrients applied in solution every 20 days.

Experiment 1. Forty four days after planting, four replicate pots each of four plants were cut to a 20mm average stubble length every 3 days for a period of 30 days. At day 30 of cutting, plants in the four replicate treatments pots were left to recover 20, 35 or 46 days before final destruction. Plants in a further group of four pots was cut to 20mm stubble length every three days for 51, 66 and 75 days. At each harvest the plant material in the leaves and tillers as well as the root material in each pot were weighed after washing and drying for 16 hours at 90?C.

Experiment 2. Forty four days after planting, the plants in four replicate pots each of four plants were cut to a 20mm average stubble length above ground level and then recut to 20mm every 10, 20 or 30 days. Plants in a further two groups of four pots were cut to 20mm at day 44 and then allowed to recover for the next 30 or 65 days. At each harvest the plant material in the leaves and tillers as well as the roots per pot were weighed after washing and drying for 16 hours at 90?C.

Results and Discussion

Experiment 1. Uncut plants continued to grow both leaf and root over the entire experiment. Results were analysed using ANOVA. Plants kept continually cut short had significantly less root weight ($P<0.05$) than did those rested for more than 20 days. Plants rested for 46 days developed aerial parts only 40% of those of 109 day old uncut plants, while the roots were only 22% of the uncut 109 day old plants.

Dry weights of the leaf and roots for total pot content are summarised in Table 1.

Table 1. Leaf Cutting Regimes	**Experiment 1.**	**Recovery**	
	Plant days	**Leaf (gm)**	**Roots (g)**
Uncut 74 days	74	13.9 [a]	7.1 [a]
Uncut 109 days	109	17.9 [b]	13.5 [b]
First cut day 44/Cut 30/ Rest 20	94	2.2 [c]	1.3 [c]
First cut day 44/Cut 30/ Rest 35	109	4.2 [d]	2.1 [d]
First cut day 44/Cut 30/ Rest 46	120	7.2 [e]	3.0 [e]
First cut day 44/ Cut 51 days 20mm	94	0.7 [f]	0.9 [f]
First cut day44/ Cut 66 days 20mm	109	0.7 [f]	1.0 [cf]
First cut day44/ Cut 75 days 20mm	120	0.7 [f]	0.7 [f]

Columns with different superscripts differ significantly at $P<0.05$.

Experiment 2. With rest periods of up to 30 days there was still a significant penalty in both leaf and root weight as shown in Table 2. Severe defoliation reduces plant recovery time as well as reduced access to moisture and nutrients due to with smaller root volume.

Table 2. Leaf Cutting Regimes	**Experiment 2.**	**Varying Intervals**	
	Plant days	**Top**	**Roots**
Cut day 44/Uncut next 30	74	9.7 [a]	4.2 [a]
Cut day 44/Uncut next 65	109	18.0 [b]	12.3 [b]
Cut day 44/20mm every 10days	109	2.1 [c]	1.6 [c]

Cut day 44/20mm every 20 days	109	5.9 [d]	3.3 [d]
Cut day 44/20mm every 30 days	109	10.4 [a]	6.6 [e]

Columns with different superscripts differ significantly at P<0.05

Plate 1. Ryegrass growing in tubes.

Plate 2. Forty days rest on L with 75 days at 20mm on R

Conclusion

The consequences of severe and prolonged grazing of pastures on root development are rarely considered by extensive graziers. Results from this study highlight how sensitive roots are to severe grazing and show that it is no wonder pastures grazed severely suffer nutrient and moisture deprivation, as root volume is critically lower than pastures grazed less severely.

References

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