Changes in the Physiology of Tall Fescue during Regrowth

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Introduction Tall fescue (*Festuca arundinacea* Schreb .) is a widely utilised dairy pasture species due to its wide range of adaptability (Langer , 1990) , but little is known about the effect of leaf stage based defoliation management on this species . Grazing management decisions should be based on an understanding of the physiological changes that occur in the grass plant throughout the regrowth cycle . The aim of the present study was to investigate changes in tall fescue during regrowth to establish a basis for optimum defoliation management of tall fescue pastures .

Materials and methods Glasshouse treatments consisted of one preliminary harvest followed by 5 sequential harvests when each new leaf had regrown , up to the 5-leaf stage (5 live leaves per tiller) . Leaf tissue , stubble tissue below 50 mm and roots were collected at each harvest . Root and stubble samples were analysed for water-soluble carbohydrates (WSC) , and metabolisable energy (ME) was calculated using dry matter (DM) digestibility measurements of leaf material .

Results and discussion A positive linear relationship ($r^2 \geqslant 0.61$) between stubble WSC levels and the regrowth capacity of tall fescue confirmed that WSC reserves play an important role in the entire plant regrowth cycle following defoliation . Leaf and root regrowth commenced at a similar time in tall fescue plants following defoliation , with both leaf and root DM yields reaching their pre-defoliation levels between the 2-leaf and 3-leaf stages . Root growth increased until the 4-leaf stage and then stabilized , while leaf growth continued to increase until the 5-leaf stage of regrowth . Leaf and root growth , therefore , appeared to be assigned equal priority for energy allocation , unlike perennial ryegrass (*Lolium perenne* L .) , for which leaf regrowth has a higher priority for allocation of WSC reserves following defoliation compared with roots (Donaghy and Fulkerson , 1998) . This finding is in agreement with the work of Kemp et al . (2001) , who found that tall fescue allocated more of its biomass to roots and pseudostem compared with perennial ryegrass . The ME concentration of tall fescue decreased with increasing leaf stage (Table 1) , due to decreasing digestibility of plant tissue with age .

Table 1 *Stubble dry matter (DM) (mg/tiller) , root and leaf DM (mg/plant) , and leaf metabolisable energy (ME) (MJ/kg DM) before defoliation and at each corresponding leaf regrowth stage .*

Leaf regrowth stage (leaves/tiller)	Stubble DM (g/plant)	Root DM (g/plant)	Leaf DM (g/plant)	Leaf ME (MJ/kg DM)
0	0 .87	1 .50	3 .94	10 .7
1	0 .69	0 .80	0 .56	11 .3
2	0 .89	1 .29	2 .48	10 .9
3	0 .89	1 .65	4 .37	10 .4
4	1 .17	2 .19	6 .75	10 .1
5	1 .44	2 .09	7 .11	9 .2
LSD (P = 0 .05)	0 .29	0 .62	0 .91	0 .2

Conclusions These results emphasise the dichotomy of this species , with relatively frequent defoliation at the 2-leaf stage required to maintain an ME concentration above 10 .5 MJ kg^{-1} DM , contrasting with relatively infrequent defoliation at the 4-leaf stage required to maximise pasture production and persistence . A field study investigating the rotational grazing of tall fescue at different leaf regrowth stages would be valuable to confirm the most effective range of grazing intervals in the field .

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