Effect of defoliation interval on regrowth of leaves and roots, and tiller number of cocksfoot plants

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Introduction The key to defoliation management for optimal production and persistence of pasture lies in the use of a physiological basis for defoliation interval (specific to plant type), as opposed to a regime based on time or the height of herbage. The full expansion of a particular number of leaves/tiller is a useful plant-related indicator of optimal defoliation timing. Leaf regrowth stage ('leaf stage') reflects the stage of plant recovery from defoliation as regards plant energy levels (Fulkerson & Donaghy, 2001). The level of water-soluble carbohydrate (WSC) reserves in grass tiller bases influences the rate of regrowth after defoliation, affecting the rate of shoot growth, root growth and tillering. This study was aimed to determine the influence of leaf stage-based defoliation interval on regrowth of leaves and root, and on tiller number of 'Kara' cocksfoot plants up to 24 days after defoliation.

Methods Each leaf stage was defined as the time required to produce the appropriate number of fully expanded leaves/tiller. Treatments were based on defoliation intervals of 1, 2 and 4-leaf stages of regrowth, with treatments terminated when the 1-leaf defoliation interval had been completed 4 times, the 2-leaf interval 2 times and the 4-leaf interval once. Selected plants were harvested destructively immediately after cessation of treatments (H1) and at 5 days, 10 days and 24 days after H1. Leaf, root and tiller dry matter (DM) yield were determined at each harvest event, and tiller number/plant was determined at 24 days after H1.

Results Leaf, root and tiller DM yields related closely to defoliation interval, with a general trend of increasing regrowth with increasing defoliation interval. A significantly lower ($P<0.05$) DM yield was associated with defoliation at 1 leaf/tiller compared with 4 leaves/tiller, for all plant components, lasting until 24 days after H1 (Table 1). A significant difference ($P<0.05$) in tiller number between all treatments had developed by 24 days after H1. Repetitive defoliation at the 1-leaf stage resulted in a mean of 42±5 tillers/plant, while defoliation at the 2-leaf and 4-leaf stages resulted in a mean 63±5 and 83±5 tillers/plant, respectively.

Table 1 Effect of defoliation interval on DM accumulation from H1 to 24 days after H1

	Leaf stage	H1	5d	10d	24d
Leaf	1L	0,40	0,20	0,52	2,24
(g/plant)	2L	3,06	0,37	1,14	6,24
	4L	9,22	0,91	2,68	7,39
LSD (P = 0.05)		1,52	0,29	0,79	3,43
Root	1L	1,72	1,27	1,37	1,49
(g/plant)	2L	2,53	1,68	2,23	2,84
	4L	6,14	4,31	5,36	5,56
LSD (P = 0.05)		1,15	1,44	1,42	1,42
Tiller	1L	37,0	35,0	39,0	30,0
(mg/tiller)	2L	52,0	43,0	38,0	37,0
	4L	75,0	62,0	52,0	57,0
LSD (P = 0.05)		10,0	20,0	6,0	12,0

Conclusions Less frequent defoliation of cocksfoot plants leads to greater leaf, root and tiller DM accumulation during subsequent recovery. The critical defoliation interval in terms of influencing regrowth is at 2 leaves/tiller. Defoliation at 1 leaf/tiller is unsatisfactory for regrowth, most likely through depletion of WSC reserves. Defoliation at 2 leaves/tiller is adequate for recovery but does not maximise regrowth. This study suggests that a rotation based on the 4-leaf stage will maximise leaf, root and tiller DM accumulation. Rawnsley *et al.* (2002) found that WSC levels increase significantly in cocksfoot stubble and roots at the 4-leaf stage of regrowth, indicating that this is the point at which WSC supply from photosynthesis exceeds that needed for growth and respiration. Tiller number also reflects the effect of defoliation on energy reserves and provides further support for this defoliation management recommendation.

References

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