QRLT-2000-01843

Assessment of the practicality and effect of mowing on the free-living stages of nematodes on pasture.
Deliverable 10
P7

M. Eysker
Division of Parasitology and Tropical Veterinary Medicine, Utrecht University, P.O. Box 80,165, 3508 TD Utrecht, The Netherlands.

Background

Any strategy that includes evasive grazing management for the control of gastrointestinal nematode infections implies that pastures have to be left for some time before animals can be reintroduced. The grass produced during that time has to be harvested by the farmer. The options include grazing the pasture by another species or by mowing. In the latter case the grass can be fed immediately to housed animals or can be used for producing silage or hay.
For parasite control grazing another species will help considering the relative host specificity of the parasites involved. In particular a change from ruminants to horses would have benefits because only *Trichostrongylus axei* is shared. On the other hand a horse pasture would not be the favorite pasture for grazing cattle or sheep.
Mowing may have an effect on survival of the free-living stages of gastrointestinal nematodes. Larvae will be removed by taking away the herbage after mowing. More important is that after mowing eggs and larvae will be more exposed to desiccation and ultra violet light, both conditions that are unfavorable for survival. Surprisingly little information is available on the effect of mowing on parasitic nematodes. In the Netherlands moves to mown pasture at 2-3 week intervals have been recommended for calves for many decades (Oostendorp and Harmsen, 1968). However, a negative affect of mowing on pasture infectivity has only been demonstrated before the first cut (Borgsteede, 1977). Highly contradictory preliminary results were obtained on the effect of mowing on cattle parasites during the grazing season, varying from over 80% efficacy in one year to no effect at all in the following year (Eysker, unpublished results). The present report describes some preliminary data on parasites of small ruminants. The questions addressed are:

1. What is the effect of mowing on pasture infectivity?
2. Is it safe to feed freshly mown grass of small ruminant pastures to housed small ruminants?

The latter question came from an organic goat farmer that fed freshly mown grass to housed goats at night.

Experimental Design
During the grazing experiments of 2001, 2002 and 2003 at Utrecht University attempts were made to study the effect of mowing.

2001
Two groups of 12 weaned naturally infected lambs (G1, G2) were moved to two separate pastures of 0.35 ha each (#311 and 321) on 02-07 and moved again on 23-07 to similar pastures (#331 and 341) and combined as one group on 13-08. The planning was that 311 and 331 would be mown after sufficient re-growth had occurred and that 321 and 341 would not be mown. Unfortunately it started to rain in the week that mowing was planned in 311 and it did not stop raining until October and mowing did not make sense. Consequently, it was not possible to do any observations in 2001.

2002
The effect of mowing was studied on the plots #311, 321, 331 and 341 grazed separately by 4 groups of 8 ewes with twin lambs between 01-05 and 22-05. Ewes from G1 (311) and G2 (321) were fed 500,000 spores of *Duddingtonia flagrans*/kg bodyweight daily. Pairs of tracer lambs were grazed from 19-06/03-07 (Day 49-63), 24-07/07-08 (Day 84-98) and 28-08/11-09 (Day 119-133) and necropsied 2-3 weeks later. Plots 311 and 331 were mown on 11-07 (Day 71) and Plots 321 and 341 on 16-08 (Day 107).
Fecal egg counts, differentiation of fecal larval cultures of the ewes and pasture larval counts were performed weekly.

2003
The experiment of 2002 was repeated with the following minor modifications:

- Turnout of ewes and lambs on 311, 321, 331 and 341 was on 06-05 and the move to other plots on 26-05.
- Pairs of tracer lambs were grazed from 16-06/30-06 (Day 42-56), 04-08/18-08 (Day 91-105) and 01-09/15-09 (Day 119-133) and necropsied 2-3 weeks later.
- Plots 311 and 331 were mown on 07-07.
- Before mowing on 07-07, 2 replicate herbage samples were collected from 311 and 331. In addition 2 replicate samples were collected from the mown herbage immediately after mowing. This in an attempt to estimate the risk of feeding freshly mown grass to housed small ruminants.

Methods
Fecal egg counts were performed with a modified McMaster method. Fecal cultures were

performed with the method of Roberts and O'Sullivan (1950). Pasture larval counts and necropsy and worm counts procedures were performed according to the methods of Eysker and Kooyman (1993).

Results

2002

The mean fecal egg counts of the ewes between 01-05 and 22-05 are given in Table 1, the pasture larval counts for *Haemonchus contortus* in Table 2 and the mean tracer worm counts in Table 3.

Table 1: Mean numbers of eggs per gram feces (EPG) in the groups of ewes in 2002

Date	Plot 311	Plot 321	Plot 331	Plot 341
01-05	300	344	425	200
08-05	147	241	434	156
15-05	625	419	681	412
22-05	460	435	595	388

Table 2: Numbers of *Haemonchus* larvae/kg dry herbage on plots 311, 321, 331 and 341 grazed each by 8 ewes and their twin lambs from 01-05/22-05-02. Pairs of tracer lambs were grazed from 19-06/03-07, from 24-07/07-08 and from 28-08/11-09; # indicates mowing

Date	Plot 311 Mown 11-07	Plot 321 16-08	Plot 331 11-07	Plot 341 16-08
01-05	0	0	0	0
08-05	0	0	0	0
15-05	0	0	0	0
22-05	0	89	18	18
29-05	73	4905	8995	2159
05-06	1082	3850	7967	547
12-06	851	2963	930	1206
19-06	1409	3314	2332	993
26-06	229	132	428	63
03-07	337	437	838	197
11-07	158#	66	52#	78
17-07	192	119	149	62
24-07	557	236	440	33
31-07	39	202	170	26

07-08	79	250	184	0
16-08	26	23#	0	0#
21-08	-	74	68	115
28-08	26	33	-	0
04-09	62	34	45	0
11-09	0	19	0	0

Moderate mean numbers of eggs per gram of feces (EPG) were observed in ewes (Table 1) and the fecal larval cultures demonstrated that *H. contortus* was the dominating species. Neither the pasture larval counts nor the mean tracer worm counts suggest a major effect of mowing on pasture infectivity. However, a decrease in pasture infectivity clearly occurred before the second groups of tracers were introduced.

Table 3: Mean worm counts of pairs of tracer lambs grazed on paddocks 311, 321, 331 and 341 from 19-06/03-07-02; 24-07/07-08-02 or 28-08/11-09-02; 311 and 331 mown on 11-07; 321 and 341 mown on 16-08. Hc = *Haemonchus contortus*; Tc = *Teladorsagia circumcincta*; Ta = *Trichostrongylus axei*; Tv = *T. vitrinus*; Cc = *Cooperia curticei*; Nb = *Nematodirus battus*; Sp = *Strongyloides papillosus*

	19-06/03-07				**24-07/07-08**				**28-08/11-09**			
	311	**321**	**331**	**341**	**311**	**321**	**331**	**341**	**311**	**321**	**331**	**341**
Mown	**11-7**	**16-8**	**11-7**	**16-8**	**11-7**	**16-8**	**11-7**	**16-8**	**11-7**	**16-8**	**11-7**	**16-8**
Hc	1000	5200	5575	575	250	587	875	587	0	100	100	0
Tc	100	2325	1575	300	12	262	200	125	0	0	0	0
Ta	75	50	125	50	25	25	37	50	0	0	0	0
Tv	0	225	75	150	12	25	62	25	0	0	0	0
Cc	0	0	0	0	0	0	0	0	0	0	0	0
Nb	25	0	25	50	637	162	412	150	400	1150	300	1850
Sp	0	0	0	0	0	0	0	0	0	25	75	0

2003

The mean EPG of the ewes between 06-05 and 26-05 are given in Table 4, the pasture larval counts for *H. contortus* in Table 5 and the mean tracer worm counts in Table 6. The numbers of larvae on plots 311 and 331 before mowing on 07-07, and in the removed grass after mowing are given in Table 7

Table 4: Mean EPG in the groups of ewes in 2003

Date	Plot 311	Plot 321	Plot 331	Plot 4
06-05	381	459	481	659
12-05	1206	1488	838	1203
19-05	1691	1747	1150	1469
26-05	2016	2209	1347	1437

The mean EPG of the ewes was higher in 2003 than in 2002 with again *H. contortus* as dominating species. Again the pasture larval counts did not suggest a major effect of mowing on pasture infectivity, this despite the very dry and warm conditions (for the Netherlands) after mowing. The tracer *Haemonchus* burdens were lower in the pairs grazed on the mown plots (311 and 331) than on the non-mown plots (321 and 341) between 04-08 and 18-08. However, for 311 that was also the case for the tracers grazed before mowing and despite the extremely dry conditions in July fair numbers of *Haemonchus* were still acquired on the mown pastures in August. Thus, it cannot be concluded that the tracer worm burdens indicate a major reduction in pasture infectivity as a result of mowing.
Table 7 demonstrates that grass that is removed from pasture immediately after mowing can contain similar numbers of larvae as in samples collected before mowing.

Table 5: Numbers of *Haemonchus* larvae/kg dry herbage on plots 311, 321, 331 and 341 grazed each by 8 ewes and their lambs between 06-05/26-05-03. Pairs of tracer lambs were grazed from 16-06/30-06; 04-08/18-08 and 01-09/15-09; # indicates mowing

Date	**Plot 311**	**Plot 321**	**Plot 331**	**Plot 341**
	Mown 7-7	**-**	**7-7**	**-**
06-05	0	0	0	0
12-05	0	0	0	0
19-05	0	0	0	0
26-05	0	2057	62	112
02-06	0	45	92	32
09-06	37	533	278	2913
16-06	1841	764	203	536
23-06	204	402	87	1247
30-06	323	281	240	28
07-07	167#	141	308#	109
14-07	16	69	31	943
21-07	0	120	319	356
28-07	199	158	43	122
04-08	180	110	30	0

11-08	34	66	23	35
18-08	105	0	23	0
25-08	0	0	0	0
01-09	114	13	0	0
08-09	166	0	21	28
15-09	0	0	76	0

Table 6: Mean worm counts of pairs of tracer lambs grazed on 311, 321, 331 and 341 from 16-06/30-06-03; 04-08/18-08-03 or 01-09/15-09-03; 311 and 331 mown on 07-07. *Hc = Haemonchus contortus*; *Tc = Teladorsagia circumcincta*; *Ta = Trichostrongylus axei*; *Tv = T. vitrinus*; *Cc = Cooperia curticei*; *Nb = Nematodirus battus* (+ some *N. filicollis*); *Sp = Strongyloides papillosus*

	16-06/30-06				**04-08/18-08**				**01-09/15-09**			
	311	**321**	**331**	**341**	**311**	**321**	**331**	**341**	**311**	**321**	**331**	**341**
Mown	7-7	-	7-7	-	7-7	-	7-7	-	7-7	-	7-7	-
Hc	3800	10275	12050	18375	1575	3150	1350	4950	25	450	275	675
Tc	650	1325	1525	1450	125	275	100	750	0	75	12	25
Ta	25	25	575	175	50	25	50	775	0	0	50	25
Tv	50	150	1350	700	50	0	25	75	0	0	0	0
Cc	150	75	1800	1225	0	25	50	825	0	0	0	0
Nb	0	0	25	50	100	100	50	125	875	1000	1050	1600
Sp	0	25	0	0	0	75	50	75	0	0	0	0

Table 7: Numbers of larvae/ kg of dry herbage in samples collected from 311 and 331 on 07-07-03 immediately before mowing (BM) and, from the grass that had been cut, immediately after mowing (Grass).

	311						**331**					
	BM			**Grass**			**BM**			**Grass**		
	A	**B**	**Mean**	**A**	**B**	**Mean**	**A**	**B**	**Mean**	**A**	**B**	**Mean**
H. contortus	237	97	**167**	108	115	**111**	392	224	**308**	287	943	**615**
T. circumcincta	13	32	**22**	76	48	**62**	0	11	**6**	18	9	**13**
Trichostrongylus	138	54	**96**	76	48	**62**	36	22	**29**	9	28	**18**
N. filicollis	0	11	**5**	0	0	**0**	18	0	**9**	0	9	**4**
Oes/Chab	13	11	**12**	11	0	**5**	0	11	**6**	9	0	**4**

Discussion and Conclusions

For several reasons only preliminary data could be collected on the effect of mowing. An attempt will be made in 2004 to add data, if alone to get publishable results. Nevertheless, some conclusions can already be drawn.

The effect of mowing, if any, is not large. The proven effect of mowing early in the grazing season on calf pastures (Borgsteede, 1977) has resulted that farmers and extension workers think that a mown pasture is safe. Unfortunately, the preliminary data presented here demonstrate that this is not necessarily true for sheep pastures that have been contaminated earlier in the grazing season. The survey on goat farms also demonstrated that. Most goat farmers indicated that they had mown in between grazing periods. Nevertheless, problems occurred on some farms applying mowing in 2002 (Eysker et al., 2002). Thus, we can already conclude that we have to convince farmers that they should not only rely on mowing as a measure to get clean pasture.

Some preliminary data on dairy goat farms indicate that, like on cattle pastures, the over-wintering larvae die rapidly in May. Therefore, a delay of turnout of dairy goats until mown pastures are available by the end of May is a useful and feasible recommendation. However, it cannot be used for sheep.

The results presented in Table 7 indicate that housed goats or sheep may acquire sizable infections when they are fed fresh grass that has been mown on a contaminated pasture. This is important knowledge for the organic dairy goat farmers, because some of them have the habit of feeding fresh grass to the goats when they are housed overnight. Probably it is better to use grass cut from contaminated pastures only for producing hay and silage.

References:

Borgsteede, F.H.M. 1977. The epidemiology of gastrointestinal helminth infections in young cattle in the Netherlands. Ph.D. Thesis, Utrecht University

Eysker, M., Kooyman, F.N.J., 1993. Notes on necropsy and herbage processing techniques for gastrointestinal nematodes of ruminants. Vet. Parasitol., 46, 204-213.

Eysker, Maarten, Eekeren, Nick van, Hall, Yvette van der, Hecke, Ilse van, 2002. Maagdarmworminfecties op organische melkgeitenbedrijven in Nederland. Internal Report for Organic Dairy Goat Farmers, 14 pp.

Oostendorp, D., Harmsen, H.E., 1968. Agricultural control measures against intestinal parasites in cattle. Neth. J. Agric. Sci., 16, 177-186.

Roberts, F.H.S., O'Sullivan, P.J., 1950. Methods for egg counts and larval cultures for strongyles

infesting the gastrointestinal tract of cattle. Austr. J. Agric. Res., 1, 99-102.