

# Impacts of sub-surface drainage and "on-off" grazing in reducing wet soil pugging damage on southern Victorian dairy pastures - pasture effects

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## Abstract

The impacts on pasture of subsurface drainage and grazing duration on winter wet dairy pastures were evaluated in a study in south-west Victoria during 2000 - 2002. Subsurface drainage resulted in non-significant increases of up to 800 kgDM/ha in annual pasture dry matter (DM) accumulation compared to "on-off" grazing wet soils for periods of up to four hours. Most of the pasture DM losses to undrained treatments occurred during the late winter-early spring period, a period of critical feed supply on farm. Following the end of wet soil conditions in mid spring, the more heavily damaged treatments appeared to exhibit some "compensatory" pasture growth with a substantial recruitment of new ryegrass tillers by the following autumn contributing to the recovery of the pasture. In contrast, the drained pastures with relatively little soil disturbance suffered a decline in tiller density.

## Key Words

Drainage, on-off grazing, pugging, wet soils, ryegrass tiller densities

## Introduction

Grazing pastures under waterlogged conditions is a major problem facing the dairy industry in southern Victoria. Grazing under such conditions causes varying degrees of pugging damage to both pasture and soil (1). Recent New Zealand research has shown that pugging by cattle can reduce pasture dry matter (DM) production by 30-90% and the effect last for up to two years (2). On farm strategies to reduce the occurrence and severity of wet soil pugging damage include the "on-off" grazing system of limiting cow grazing time (3) and the installation of subsurface drainage to remove excess water from the soil (4). This paper reports on some effects on pasture of a study during 2000-2002 to evaluate these two strategies.

## Methods

A grazing experiment near Terang in south-west Victoria (38°4'S, 142°55'E) from winter 2000 to autumn 2002 investigated the effects of grazing wet soils using a three replicate, incomplete combination of subsurface drainage, different durations of "on-off" grazing by dairy cows and grazing at different soil moisture content treatments. Subsurface tile drainage was installed to provide drained (D) and undrained (U) treatments. Plots were grazed with cows for 2 hours (SH), 4 hours (M), 8 hours (L) or 8 hours plus an additional 2 hours the following day (L+2) (for 2001 grazings only). Soil moisture content (0-15 cm in the undrained) at grazing were either at or close to saturation (SA), at field capacity (FC), or dry (D - at least 6% below field capacity). SA treatments were grazed five times each with a stocking intensity of 250 cows/ha at 26-30 day intervals under wet soil conditions during winter-spring in both 2000 and 2001. For the remainder of the year (D conditions), plots were grazed as per the farms normal grazing rotation. Pastures were sown to perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) two years prior to the commencement of the trial. Pasture dry matter (DM) accumulation was determined from pre and post grazing pasture cuts from 12 random 0.0625 m<sup>2</sup> quadrats per plot. Ryegrass tiller populations were measured in June 2001, December 2001 and May 2001 from 15 random cores (80 mm diameter) per plot. Data were analysed by analysis of variance using residual maximum likelihood (5).

## Results

All the drained treatments had a small, but non significant trend to higher total pasture DM accumulation than their equivalent undrained treatments (Table 1). The maximum DM yield advantage of drainage over its equivalent grazing length undrained treatment was 800 kgDM/ha for the 4 hour (M) grazing length. Greater reductions occurred for the longer "on-off" grazing lengths (L, L+2) in the undrained treatments, with most of the losses occurring during the "pugging" and to a lesser degree during "post-pugging" periods. Compared to the highest yielding undrained (M), L+2 suffered an 80% and L a 39% reduction in herbage accumulation over the pugging period.

**Table 1. The total (Apr 01-Jan 02), pugging period (Jul - Oct) and post-pugging (Oct – Jan) herbage accumulation (kgDM/ha) for the 2001 growing season for a range of drained and undrained treatments grazed under saturated (SA) soil conditions. (Grazing time SH=2hr, M=4hr, L=8hr, L+2=8+2hr).**

Growth Period	<i>Undrained</i>				<i>Drained</i>			l.s.d (P=0.05)
	SH*SA	M*SA	L*SA	L+2*SA	SH*SA	M*SA	L*SA	
Total	8,667	9,873	7,540	5,366	8,840	10,677	7,815	2,748
Pugging	3,456	3,291	2,123	687	2,907	3,349	2,586	957
Post-pugging	3,744	4,577	3,291	3,458	4,534	5,284	3,695	909

June 2001 tiller densities were higher in drained than undrained treatments but similar across grazing durations (Table 2). In December 2001, tiller densities on undrained soils decreased from 2,436 to 1,610/m<sup>2</sup> as grazing length increased from 2 (SH) to 8+2 (L+2) hours but on drained soils increased from 2,314 to 3,155/m<sup>2</sup> as grazing duration increased to 8 (L) hours. Tiller populations in May 2002 were not affected by grazing duration on undrained soils with 3,168 and 2,965/m<sup>2</sup> for 2 (SH) and 4 (M) hour grazings compared with 3,193 /m<sup>2</sup> at 8 hr on drained soils.

**Table 2. Density of perennial ryegrass tillers (no/m<sup>2</sup>) from November 2000 to May 2002 of drained and undrained treatments grazed under saturated soil conditions. (Grazing time SH=2hr, M=4hr, L=8hr, L=8+2hr)**

Assessment Date	<i>Undrained</i>				<i>Drained</i>			l.s.d (P=0.05)
	SH*SA	M*SA	L*SA	L+2*SA	SH*SA	M*SA	L*SA	
Nov 00	3,251	2,821	1,803	-	3,443	4,501	4,483	1,115
June 01	2,651	2,061	2,398	3,251	4,387	4,641	4,571	1,536
Dec 01	2,436	2,261	2,022	1,610	2,314	2,468	3,155	880
May 02	3,168	2,965	3,466	3,145	1,685	1,505	3,193	808

## Discussion and conclusion

Results indicate that on this soil type, subsurface drainage resulted in only comparatively small improvements in total annual pasture DM accumulation compared to the use of "on-off" grazing for four hours or less. Heavily damaged treatments, (such as in U:L+2) suffered much of their herbage DM accumulation losses during the early spring "pugging" period, a time when feed is often in shortest supply and most valuable on farm. Although herbage DM accumulation in the post-pugging period for the more heavily damaged treatments was lower than the shorter grazing length - less damaged treatments, there were suggestions of some enhanced, "compensatory" growth occurring in the damaged pasture. Part of this enhanced growth being a recruitment of new ryegrass tillers by the following autumn to replace those lost by treading in the previous "pugging" period. It is proposed that providing pugging is not too severe, the bare spaces and reduced pasture cover resulting from pugging damage can stimulate ryegrass tillering and assist in the recovery of the pasture. Further, the comparative lack of soil disturbance and pasture damage in the shorter grazing time drained treatments do not provide these same conditions to promote tillering, leading to a gradual reduction in ryegrass tiller densities in these drained treatments.

## References

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