

Water-soluble carbohydrate (WSC) concentrations in Ireland and Norway of *Lolium perenne* differing in WSC genotype and receiving varying rates of N fertiliser

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Introduction Cultivars bred for elevated water-soluble carbohydrate (WSC) concentration may have improved grass ensilability and nutritive value. Increasing rates of application of N fertiliser generally reduce grass WSC concentration, although it is unknown if the response is similar for normal and elevated WSC genotypes or if these factors interact with growing conditions. This experiment evaluated the effects on grass WSC concentration of varying N fertiliser application rates to perennial ryegrass cultivars of high or normal WSC genotype grown in Ireland and Norway.

Materials and methods The experiment was conducted in Ireland (Grange) and Norway (Saerheim) in two years (Y). It was a split-plot randomised complete block design containing four replicates; replicates consisted of three or four main plots providing for successive harvests (early June (H1), early Aug. (H2) and late Sept.(H3) in Norway and late May (H1), early July (H2), mid-Aug. (H3) and early Oct. (H4) in Ireland). Within main plots, 2 cultivars x 4 (Norway) or 5 (Ireland) rates of inorganic N fertiliser (N_r) were fully randomised. The two diploid intermediate heading perennial ryegrass cultivars (Aberdart: selected for elevated WSC concentration and Fennema: control) were sown as monoculture plots. The rates of N fertiliser (calcium ammonium nitrate (CAN); 275 g N/kg) were equivalent to 0 (N₀), 40 (N₄₀), 80 (N₈₀), 120 (N₁₂₀) and 160 (N₁₆₀ - Ireland only) kg N/ha. The remaining sub-plots received an application of CAN equivalent to 80 kg N/ha. All plots were harvested at each harvest period but only herbage from the main plots that recently received N_r were sampled.

Results Grass WSC concentrations are given in Table 1. Aberdart > Fennema in Ireland (169 vs. 158 g/kg DM) and Norway (263 vs. 235 g/kg DM) and Year 1 > Year 2. In Ireland, H1 had the highest values while in Norway values were highest for H1 and H2. Values decreased progressively from N₀ to N₁₂₀ in Ireland and N₄₀ to N₁₂₀ in Norway. The differences between cultivars in response to N_r were maintained across sites, harvests and years - there were not significant CxN_r, HxCxN_r, CxN_rxY (except Y1 N₈₀ in Norway) or HxCxN_rxY interactions.

Table 1 Grass WSC concentration (g/kg DM) in Aberdart and Fennema swards at each harvest (H).

Cultivar (C)	Aberdart					Fennema					Statistical summary		
	N ₀	N ₄₀	N ₈₀	N ₁₂₀	N ₁₆₀	N ₀	N ₄₀	N ₈₀	N ₁₂₀	N ₁₆₀	Sig.	s.e.	
Ireland - Y1													
H1	242	214	191	164	164	242	207	179	164	153	H	***	3.2
H2	240	201	171	147	128	233	168	174	136	132	N _r	***	3.0
H3	217	185	149	138	127	185	164	141	122	122	C	***	1.9
H4	202	162	148	137	135	181	154	134	116	123	Y	**	2.0
Ireland - Y2													
H1	275	247	209	188	169	238	235	196	175	156	HxN _r	***	6.2
H2	173	168	132	106	106	185	116	111	110	92	HxC	ns	4.2
H3	175	161	155	149	157	153	156	162	143	143	CxN _r	ns	4.2
H4	180	145	140	132	137	160	141	134	132	136	HxCxN _r	ns	8.7
Norway - Y1													
H1	350	364	308	241	-	319	331	300	221	-	H	***	3.8
H2	311	302	248	226	-	288	267	233	197	-	N _r	***	2.8
H3	291	295	230	206	-	246	266	223	204	-	C	***	2.0
Norway - Y2													
H1	319	269	216	215	-	313	239	174	182	-	Y	***	2.0
H2	304	311	284	267	-	274	271	221	206	-	HxN _r	***	5.6
H3	197	209	193	166	-	170	194	161	153	-	HxC	ns	4.5
											CxN _r	ns	3.9
											HxCxN _r	ns	7.4

Conclusions Grass WSC was higher and the difference between cultivars larger in Norway than Ireland. The negative effects of N fertiliser on WSC were similar for the two grasses across a range of conditions.