Effects of Ice Encasement during Winter on Different Cultivars of *Phleum pratense* and *Lolium perenne* in Norway

M. Jørgensen
Norwegian Institute for Agricultural and Environmental Research, Norway

Liv Østrem
Norwegian Institute for Agricultural and Environmental Research, Norway

A. K. Bakken
Norwegian Institute for Agricultural and Environmental Research, Norway

Mats Höglind
Norwegian Institute for Agricultural and Environmental Research, Norway

The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

Effects of ice encasement during winter on different cultivars of *Phleum pratense* and *Lolium perenne* in Norway

M . Jørgensen[1] *,L . Østrem*[2] *,A . K . Bakken*[3] *and M . Höglind*[4] *. Norwegian Institute for Agricultural and Environmental Research (Bioforsk)* [1] *Holt , Tromsø ;*[2] *Fureneset , Hellevik i Fjaler ;*[3] *Kvithamar ; Stjørdal ;*[4] *Særheim , Klepp , Norway , E-mail :jorgensen@bioforsk .no*

Key words : ice encasement , frost tolerance , grass , timothy , perennial ryegrass

Introduction Global warming may lead to milder winters at high latitudes (RegClim 2005) . Fluctuating temperatures and more precipitation can increase the risk of ice encasement , although more research is needed to verify this assumption . Farmers may in future prefer to grow *Lolium perenne* (L .) , which is forage grass more resistant to grazing and frequent cutting than the currently used *Phleum pratense* (L .) . *P . pratense* is generally very tolerant to ice encasement and probably more so than *L . perenne* , although there may be variety differences . The aim of this study was to compare the tolerance of different cultivars of *P . pratense* and *Lolium perenne* to ice encasement .

Materials and methods Two varieties of *P . pratense* (Engmo , Grindstad) and two of *L . perenne* (Riikka , Gunne) were spring sown in a field at Holt , Tromsø , Norway (69 .65°N , 18 .91°E) . At the end of autumn , turfs were dug out , put in growth containers and placed to form a dense sward . Single tillers from all varieties were sampled during winter for determination of ice encasement tolerance (LD_{50}) and frost tolerance (LT_{50}) ; (LD_{50} , = No of days required to kill 50% of tillers encapsulated in ice and stored in darkness at -2℃ , and LT_{50} = Temperature needed for killing 50% of the tiller population) (Larsen , 1978 ; Gudleifsson and Bj rnsson , 1989) .

Table 1 *Tolerance to ice encasement (LD_{50} , days) during winter* 06 -07 .

	P . pratense		*L . perenne*	
Month	Engmo	Grindstad	Riikka	Gunne
Nov	>44	>44	20	14
Jan	>63	46	>21	15
Mar	*	32	17	11

Not possible to estimate—data does not follow the expected curve

Table 2 *Frost tolerance (LT_{50} ,℃) during winter* 06 -07 .

	P . pratense		*L . perenne*	
Month	Engmo	Grindstad	Riikka	Gunne
Nov	<−21 .1	−19 .7	<−17	<−17
Jan	−25 .9	−19 .8	−18 .5	−15 .8
Mar	−19 .2	−14 .9	−16 .8	−12

Results and discussion The tolerance to ice encasement was much higher in *P . pratense* than in *L . perenne* (Table 1) . There was a high correlation between tolerance to frost and to ice encasement (Table 1 and 2) . The more winter hardy *P . pratense* variety Engmo was more frost tolerant and had a much higher tolerance to ice encasement than Grindstad , whereas Riikka was somewhat more tolerant than Gunne (Table 1 and 2) . Both LD_{50} and LT_{50} increased from November to January , but then decreased in March . At the same time the ambient mean monthly temperature increased from -5 .7℃ in February to 1 .5℃ in March (Figure 1) .

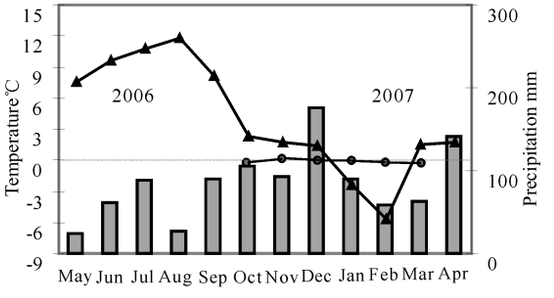

Figure 1 *Mean monthly air (▲) and at ground (●) temperatures , and precipitation from local weather station .*

Conclusion *L . perenne* is more susceptible to ice encasement than *P . pratense* . Varieties that are more frost tolerant also tend to sustain longer periods of ice encasement . More detailed climate scenarios are needed to predict the risk of ice encasement in the future .

References

Gudleifsson , B . , Björnsson , H . , 1989 . Methods for estimating ice encasement tolerance of grasses in the laboratory . *Icelandic Agricultural Sciences* 2 , 99-103 .

Larsen , A . , 1978 . Freezing tolerance in grasses . Methods for testing in controlled environments . Meld . Norges Landbruksh gskole 57 , 56pp .

RegClim . 2005 . Norges klima om 100år . Usikkerhet og økt risiko . (In Norwegian) . http ://regclim .met .no .