Effect of **water stress** on the ability of **blackcurrant** cultivars to grow under potted conditions

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Introduction

Traditionally, selections of blackcurrant cultivars were chosen based on productivity and disease resistance. However, with changing climatic conditions and reduced productivity, breeding material needs to be re-evaluated for increased adaptive and phenotypic plasticity.

Material and methods

One-year old plants of 'Ben Alder', 'Ben Gairn', 'Ben Hope', 'Ben Tirran', 'Narve Viking', 'Öyebyn' and 'Titania' were potted in a loamy sand soil and grown under greenhouse conditions. Two different water availabilities were established: 1. Fully irrigated (**FI**) and 2. Non-irrigated (**NI**) for 0, 3, 5, 7, 10 and 12 days followed by recovery at full irrigation. Plants were evaluated for evapotranspiration (**ET**), stomatal conductance (**g_s**), leaf water potential (**Ψ_{leaf}**), root regrowth, and fresh (FW) and dry weight (DW).

Results and discussion

G_s and Ψ_{leaf} were evaluated during a 12 day period for NI and FI plants of 'Narve Viking' and 'Ben Gairn' (Table 1). For NI plants g_s decreased with days of treatment. Slightly higher g_s and Ψ_{leaf} values were recorded for 'Ben Gairn' on Days 5 and 7 indicating that it was less stressed than 'Narve Viking' (Table 1). The Ψ_{leaf} values for both, FI and NI plants depended on the mean day temperature.

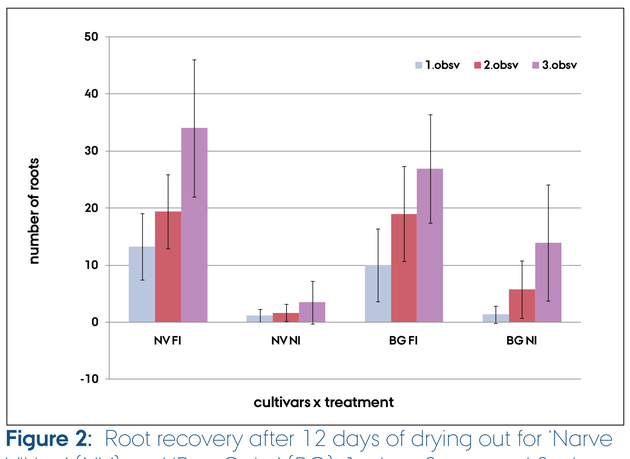

Figure 2: Root recovery after 12 days of drying out for 'Narve Viking' (NV) and 'Ben Gairn' (BG). 1. obsv, 2. osv. and 3. obsv. refers to 0, 7 or 14 days of recovery, respectively Bars represent average (n = 4), with standard error bars. The relative root regrowth is given for 3. obsv.

After 3 days, ET for NI plants was decreased (Fig. 1) and FI plants of 'Narve Viking' had a significantly higher ET rate than 'Ben Gairn' after 8 days. The ET_c did not differ between the two cultivars after 12 days of drying out (Fig. 1).

Root recovery was determined after twelve days of drying out and 0, 7 or 14 days of recovery. 'Ben Gairn' had a 52% regrowth of roots relative to FI plants after 14 days of recovery, compared to only 10% in 'Narve Viking'. These results indicated a faster recovery and better drought tolerance for 'Ben Gairn' than 'Narve Viking' (Fig. 2).

The leaf water content (WC = FW-DW/DW) of FI and NI plants was calculated for six cultivars after 12 days of treatment (Fig. 3).

There was a significant reduction in leaf WC in 'Narve Viking', 'Ben Alder', and 'Titania'. 'Ben Hope' and 'Ben Gairn' showed less reduction in WC, indicating that they are more tolerant to drought than the other cultivars. 'Öyebyn' only had few leaves, so this data needs validation.

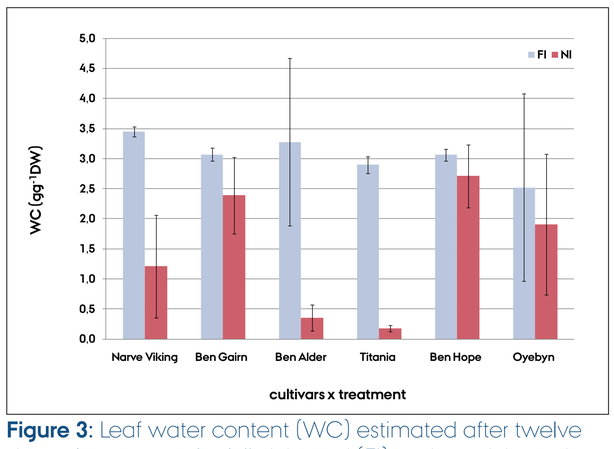

Figure 3: Leaf water content (WC) estimated after twelve days of treatment, for fully irrigated (FI) and non-irrigated (NI) plants for six blackcurrant cultivars. Data is presented as an average (n = 4), with standard error bars.

Conclusion

From this detailed study on two blackcurrant cultivars we observed that 'Ben Gairn' was more tolerant to drought stress than 'Narve Viking'. 'Ben Gairn' and 'Ben Hope' showed higher leaf water content in comparison with other cultivars indicating better drought tolerance.

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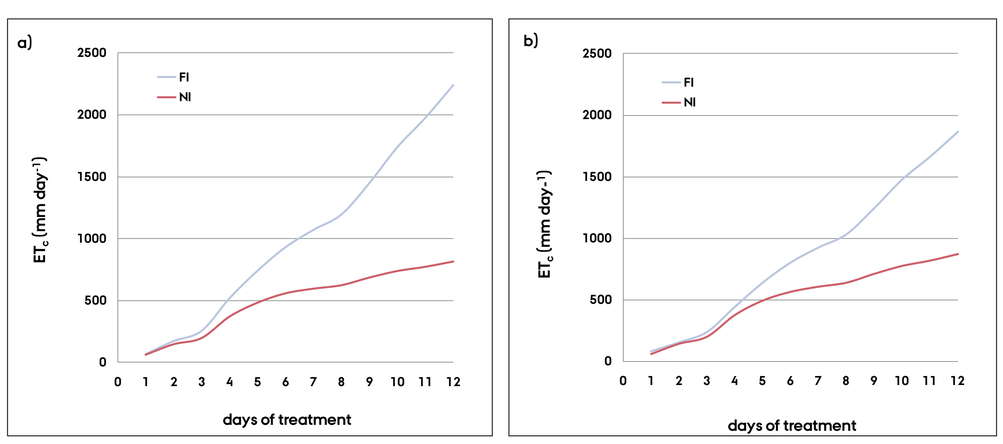
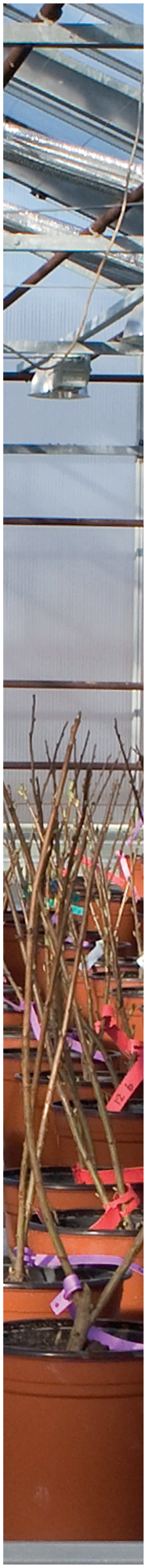


Figure 1: Accumulated evapotraspiration (ET_c) of fully irrigated (FI) and non-irrigated (NI) plants, of 'Narve Viking' (a) and 'Ben Gairn' (b). Data are presented as averages n = 16-32.

Table 1: Leaf water potential (Ψ_{leaf}) and stomatal conductance (g_s) of two fully irrigated (FI) and non-irrigated (NI) blackcurrant cultivars.

Days of drought treatment	'Narve Viking'				'Ben Gairn'				Mean day Temp (°C)
	FI Ψ_{leaf} (MPa)	FI g_s (mm s $^{-1}$)	NI Ψ_{leaf} (MPa)	NI g_s (mm s $^{-1}$)	FI Ψ_{leaf} (MPa)	FI g_s (mm s $^{-1}$)	NI Ψ_{leaf} (MPa)	NI g_s (mm s $^{-1}$)	
0	-0.78	344.20	-	-	-0.64	288.04	-	-	-
3	-0.45	270.97	-0.47	249.45	-0.56	263.23	-0.52	303.00	-
5	-1.41	278.54	-1.62	85.98	-1.51	262.89	-1.53	169.72	23.46
7	-0.64	337.27	**-1.75**	39.36	-0.54	382.46	**-0.89**	81.59	17.61
10	-1.33	191.42	-1.72	15.91	-1.34	267.42	-1.45	17.26	23.65
12	-1.35	252.76	-2.76	16.76	-1.34	217.48	-2.34	14.86	24.14



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