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The agronomic performance and nutritional content of oat and barley varieties grown in a northern maritime environment depends on variety and growing conditions

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7. Supplementary Information

Table S1. Summary of planting dates, fertilizer regime and herbicide application to oat and barley trials in Orkney, from 2012 to 2014.

Year	Planting Date	Barley fertilization (kg ha ⁻¹)	Oat fertilization (kg ha ⁻¹)	Herbicide (chemical and date of application)
2012	1 May	N 65, P 65, K 105	N 60, P 60, K 97	Tomahawk (0.75 L ha ⁻¹ (fluroxypyr-meptyl, 200 g L ⁻¹); Ally Max (20 g ha ⁻¹ (143 g kg ⁻¹ metsulfuron methyl and 143 g kg ⁻¹ tribenuron methyl). Applied on 20 June.
2013	4 April	N 65, P 65, K 105	N 50, P 50, K 81	As for 2012. Applied on 17 June.
2014	21 April	N 65, P 65, K 87	N 50, P 50, K 67	Ally Max (20 g ha ⁻¹ (143 g kg ⁻¹ metsulfuron methyl and 143 g kg ⁻¹ tribenuron methyl). Applied on 1 June.

Table S2. Summary of soil analyses for oat and barley trials in Orkney, from 2012 to 2014.

Analysis	Barley			Oats		
	2012	2013	2014	2012	2013	2014
pH	6.4	6.1	6.7	6.7	6.5	6.3
Available P (mg/l)	28.4	21.4	28.0	25.0	27.0	31.4
Available K (mg/l)	89	58	99	71	64	115
Available Mg (mg/l)	119	97	94	103	101	103
EDTA Extractable Copper (mg/l)	2.7	2.9	3.5	3.0	3.0	3.7
Hot water soluble Boron (mg/l)	0.8	0.6	0.7	0.8	0.6	0.9
EDTA Extractable Zinc (mg/l)	1.5	1.2	1.5	1.5	1.6	1.7
DPTA Extractable Iron (mg/l)	276.7	223.8	209.0	212.7	211.8	283.3
Available (Phosphate Buffer Soluble) Sulphate (mg/l)	29.2	40.8	30.0	31.2	34.9	28.6
DPTA Extractable Manganese (mg/l)	6.7	11.4	20.3	5.2	9.3	32.5

Table S3. Monthly average temperature (°C) and rainfall (mm) for 2012 to 2014 for oat and barley trial sites.

Location	Variable	Year	April	May	June	July	August	September
Orkney	Temperature	2012	6.2	8.4	10.4	12.4	13.6	11.2
Orkney	Temperature	2013	6.0	8.7	11.8	14.6	14.1	12.3
Orkney	Temperature	2014	8.3	10.0	12.9	14.5	13.6	13.2
Orkney	Rainfall	2012	82	36	45	36	89	137
Orkney	Rainfall	2013	68	53	37	42	69	127
Orkney	Rainfall	2014	48	44	45	46	124	68
Dundee	Temperature	2012	5.5	8.4	10.5	12.9	14.0	11.6
Dundee	Temperature	2013	7.6	11.4	12.2	15.7	14.3	11.9
Dundee	Temperature	2014	8.3	10.3	13.3	15.0	12.7	13.8
Dundee	Rainfall	2012	97	66	134	123	87	44
Dundee	Rainfall	2013	31	51	43	52	29	36
Dundee	Rainfall	2014	37	58	63	41	114	18
Berwick-upon-Tweed	Temperature	2012	6.3	9.3	11.9	13.5	14.8	11.8
Berwick-upon-Tweed	Temperature	2013	6.6	10.1	13.1	16.7	15.3	12.5
Berwick-upon-Tweed	Temperature	2014	9.0	11.2	14.6	15.8	13.6	13.8
Berwick-upon-Tweed	Rainfall	2012	96	79	144	129	93	82
Berwick-upon-Tweed	Rainfall	2013	43	55	24	24	27	53
Berwick-upon-Tweed	Rainfall	2014	57	91	58	34	86	26
Morfa	Temperature	2012	7.1	11.0	12.7	13.8	15.4	12.7
Morfa	Temperature	2013	6.9	9.1	12.9	16.9	15.5	13.8
Morfa	Temperature	2014	10.0	11.2	13.9	16.1	14.5	14.8
Morfa	Rainfall	2012	90	80	146	73	102	81
Morfa	Rainfall	2013	34	59	44	35	64	62
Morfa	Rainfall	2014	63	66	55	20	97	17

Table S4. Comparison of the macronutrient content (mg/100 g) of flour from grains of Vilde barley and Haga oats from different plots of the Orkney trial in 2012.

Cereal and plot number	Ash	Protein	Starch	Sugar	NDF	Fat
Vilde Barley 36	1.94	9.61	58.64	3.27	18.36	3.06
Vilde Barley 40	1.98	9.94	57.74	4.19	20.47	2.98
Vilde Barley 43	1.98	9.50	58.36	3.73	20.04	3.13
Vilde Barley 53	1.94	9.66	58.93	3.65	18.81	3.01
Vilde Barley 58	1.86	8.64	59.76	3.25	18.86	3.04
Haga Oats 5	2.55	8.08	49.65	3.36	22.99	5.35
Haga Oats 9	2.60	7.88	47.85	2.33	25.79	5.21
Haga Oats 17	2.48	7.47	48.95	2.35	24.19	5.36
Haga Oats 21	2.48	7.49	48.47	2.57	25.56	5.23
Haga Oats 26	2.50	7.59	48.54	3.28	25.57	5.12

Table S5. Trace elements in oat and barley grains ($\mu\text{g}/100\text{ g}$ of flour) of varieties grown in Orkney between 2012 and 2014.

Oat variety	Cr	Co	Ni	Se	Mo	Cd	Pb
Haga	Trace	Trace	1.0 (0.2)	Trace	0.6 (0.1) ^b	Trace	Trace
Belinda	0.2 (0.1)	0.3 (0.2)	1.0 (0.2)	Trace	0.4 (0.0) ^{ab}	Trace	Trace
Betania	0.1 (0.0)	0.7 (0.4)	1.2 (0.3)	Trace	0.4 (0.1) ^{ab}	Trace	Trace
Canyon	0.1 (0.0)	3.6 (3.1)	3.6 (2.3)	Trace	0.4 (0.1) ^{ab}	Trace	Trace
Firth	0.3 (0.2)	0.3 (0.2)	0.9 (2.0)	Trace	0.3 (0.1) ^a	Trace	0.9 (0.8)
Lennon	Trace	0.1 (0.1)	1.1 (0.2)	Trace	0.4 (0.1) ^a	Trace	Trace
P variety	0.783	0.533	0.336	-	< 0.001	-	-
P year	0.722	0.357	0.537	-	0.119	-	-
Barley variety	Cr	Co	Ni	Se	Mo	Cd	Pb
Vilde	0.0 (0.0)	0.1 (0.0)	0.1 (0.0)	Trace	0.2 (0.0)	Trace	0.1 (0.1)
Kannas	0.2 (0.1)	1.0 (0.8)	0.1 (0.0)	Trace	0.2 (0.1)	Trace	Trace
Vilgott	0.1 (0.1)	0.2 (0.1)	0.1 (0.0)	Trace	0.2 (0.0)	Trace	Trace
Bere	0.2 (0.1)	0.8 (0.3)	1.2 (1.0)	Trace	0.3 (0.1)	0.1 (0.0)	0.1 (0.0)
Concerto	0.2 (0.1)	0.2 (0.1)	0.1 (0.0)	Trace	0.2 (0.0)	Trace	Trace
Waggon	0.7 (0.5)	1.0 (0.6)	0.3 (0.2)	Trace	0.3 (0.0)	Trace	Trace
P variety	0.468	0.650	0.243	-	0.232	-	-
P year	0.100	0.030	0.183	-	0.002	-	-

Table presents means based on three growing seasons with standard errors in brackets

Different letters indicate significant differences between varieties at $P < 0.05$.

P variety and P year are the level of significance of these factors in the ANOVA tables

Where error is < 0.05 expressed as 0.0

Trace indicates levels below detection limits

Table S6. Trace element content of oat and barley grains ($\mu\text{g}/100\text{ g}$ of flour) of varieties from trials at different locations between 2012 and 2014.

Variety	Location	Cr	Co	Ni	Se	Mo [‡]	Cd	Pb
Canyon Oats	Orkney	Trace	6.2 (3.6)	4.6 (2.7)	Trace	0.1 (0.1)	Trace	0.1 (0.0)
	Berwick	Trace	0.1 (0.0)	0.4 (0.2)	Trace	0.1 (0.0)	Trace	Trace
	Morfa	0.1 (0.1)	1.1 (0.6)	0.3 (0.2)	Trace	0.1 (0.0)	Trace	0.1 (0.0)
Canyon Mean		Trace	2.5 (1.9)	1.8 (1.4)	Trace	0.1 (0.0)	Trace	0.1 (0.0)
Firth Oats	Orkney	0.4 (0.2)	0.4 (0.2)	0.4 (0.3)	Trace	0.1 (0.1)	Trace	1.6 (0.9)
	Berwick	Trace	0.5 (0.3)	0.3 (0.2)	Trace	0.1 (0.1)	Trace	Trace
	Morfa	1.3 (0.7)	1.7 (1.0)	Trace	Trace	0.1 (0.1)	Trace	Trace
Firth Mean		0.6 (0.4)	0.9 (0.4)	0.2 (0.1)	Trace	0.1 (0.0)	Trace	0.5 (0.5)
Lennon Oats	Orkney	Trace	0.2 (0.1)	0.3 (0.2)	Trace	0.1 (0.1)	Trace	Trace
	Berwick	0.8 (0.6)	1.5 (0.5)	Trace	Trace	0.1 (0.1)	Trace	Trace
	Morfa	Trace	0.8 (0.5)	0.3 (0.2)	Trace	0.1 (0.1)	Trace	Trace
Lennon Mean		0.3 (0.3)	0.8 (0.4)	0.2 (0.1)	Trace	0.1 (0.0)	Trace	Trace
Orkney Oats Mean		0.1 (0.1)	2.3 (2.0)	1.7 (1.4)	Trace	0.1 (0.0)	Trace	0.6 (0.5)
Berwick Oats Mean		0.3 (0.3)	0.7 (0.4)	0.2 (0.1)	Trace	0.1 (0.0)	Trace	Trace
Morfa Oats Mean		0.5 (0.4)	1.2 (0.3)	0.2 (0.1)	Trace	0.1 (0.0)	Trace	Trace
Concerto Barley	Orkney	0.2 (0.1)	0.2 (0.2)	0.1 (0.1)	Trace	0.2 (0.0)	Trace	Trace
	Dundee	0.1 (0.0)	0.1 (0.1)	Trace	Trace	0.2 (0.0)	Trace	Trace
Concerto Mean		0.2 (0.0)	0.2 (0.0)	0.1 (0.0)	Trace	0.2 (0.0)	Trace	Trace
Waggon Barley	Orkney	0.7 (0.6)	0.9 (0.6)	0.3 (0.2)	Trace	0.3 (0.0)	Trace	Trace
	Dundee	0.1 (0.1)	1.7 (1.5)	1.1 (1.0)	Trace	0.3 (0.1)	Trace	Trace
Waggon Mean		0.4 (0.2)	0.6 (0.3)	0.7 (0.3)	Trace	0.3 (0.0)	Trace	Trace
Orkney Barley Mean		0.5 (0.2)	0.6 (0.3)	0.2 (0.1)	Trace	0.3 (0.0)	Trace	Trace
Dundee Barley Mean		0.1 (0.0)	0.9 (0.7)	0.6 (0.4)	Trace	0.3 (0.0)	Trace	Trace

‡ Indicates a significant effect ($P < 0.05$) attributable to barley variety in the ANOVA table.

Data for each cereal cultivar in each location are means based on three growing seasons with standard errors in brackets

Where error is < 0.05 error expressed as 0.0

Trace below detection limit

Abbreviation: Berwick, Berwick-upon-Tweed.