The following supplement accompanies the article

Effects of climate and historical adaptation measures on barley yield trends in Finland

Taru Palosuo*, Reimund P. Rötter, Tapio Salo, Pirjo Peltonen-Sainio, Fulu Tao, Heikki Lehtonen

*Corresponding author: taru.palosuo@luke.fi

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Supplement.

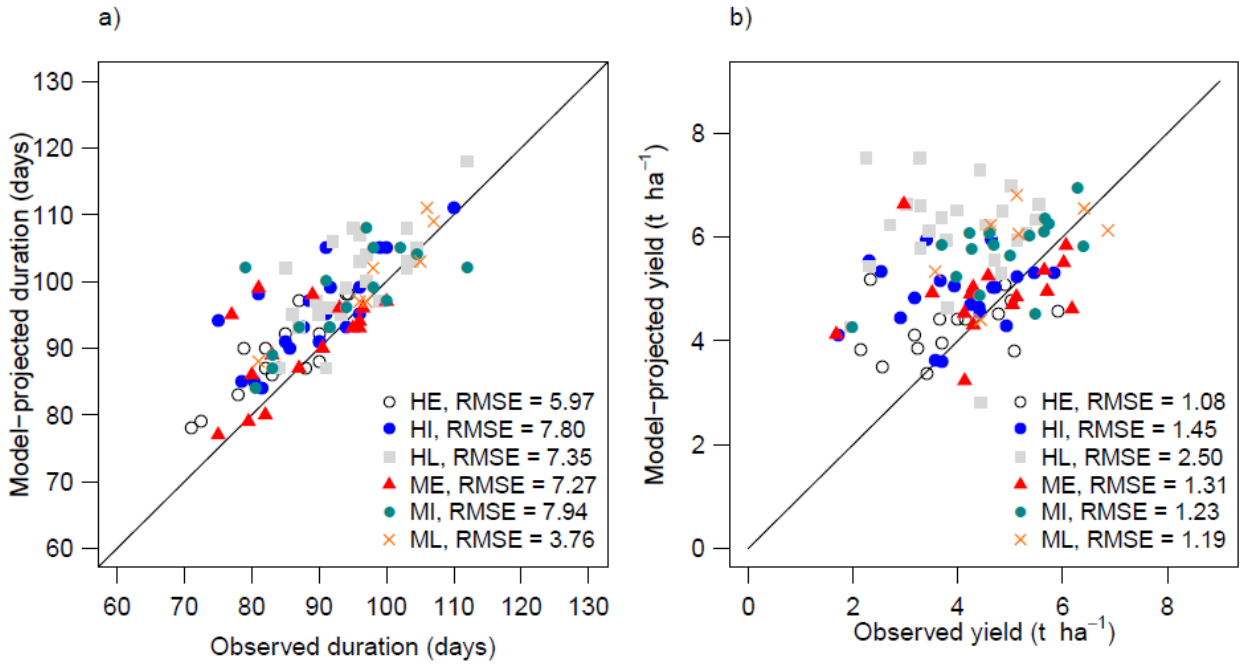

Fig. S1. Cultivar classes (HE = historical early, HI = historical intermediate, HL = historical late, ME = modern early, MI = modern intermediate and ML = modern late) tested with variety trial data from Jokioinen a) presenting duration from sowing to maturity in days and b) the yields. Durations over various seasons are predicted quite accurately, whereas observed range of yields was high in comparison to model-projected yields of different cultivar classes. Mostly the model overestimated the yields, which is natural considering the yield-limiting factors not covered by the model. Particularly the model overestimated the yields of HL cultivars, which is mainly due to insufficient amount of fertilisers applied for them to support potential growth simulated by the model. Without the HL cultivar group, the overall model RMSE for yields was 1.28 t ha^{-1} and with all cultivar groups involved 1.67 t ha^{-1}..

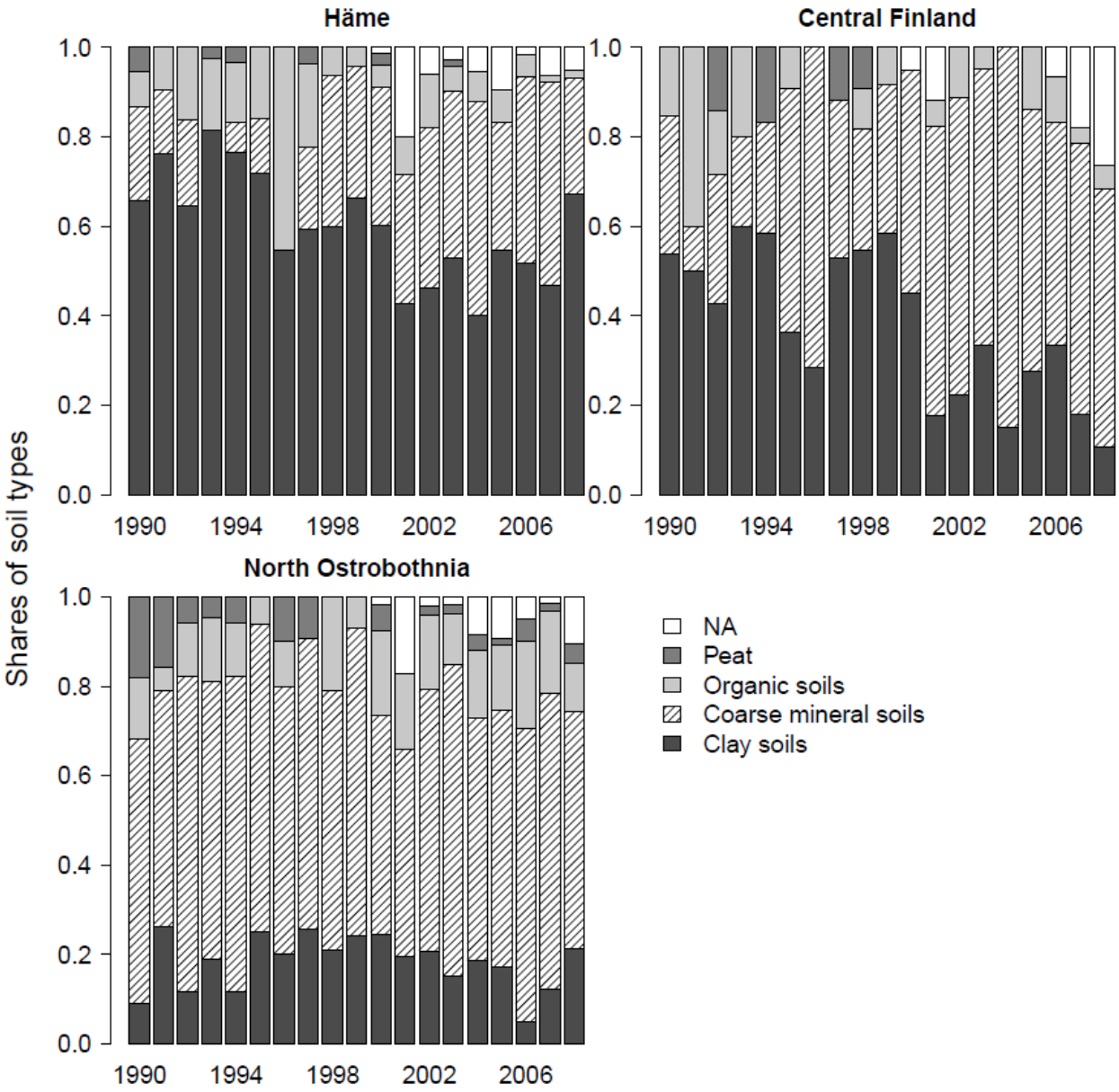

Fig. S2. Shares of soil types under barley cultivation in EVIRA data reported by farmers at the three study regions using broad categories of Finnish soil type classification. Number of observations varied from year to year being on average 53 for Häme, 16 for Central Finland and 38 for North Ostrobothnia.

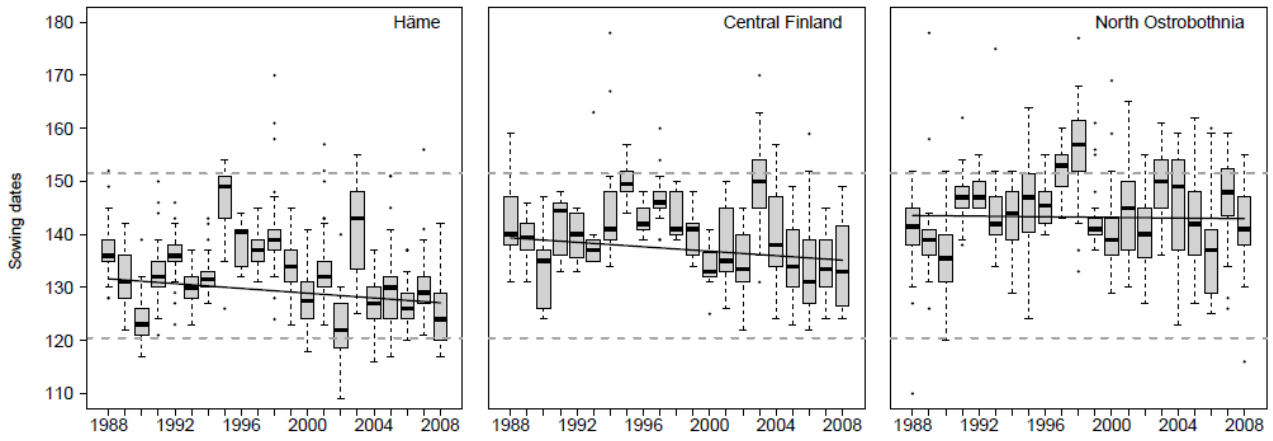

Fig. S3. Sowing dates (Julian day number) reported by farmers from 1988-2008 for the barley cultivated at the three ELY regions. Boxes indicate the lower (25th percentile) and upper (75th percentile) quartiles. The solid line within the box is the median. Whiskers indicate the most extreme data point which is no more than 1.5 times the interquartile range (between 25th and 75th percentile) from the box and outlier dots are those observations that go beyond that range. Grey dash lines indicate 1st May and 1st June.

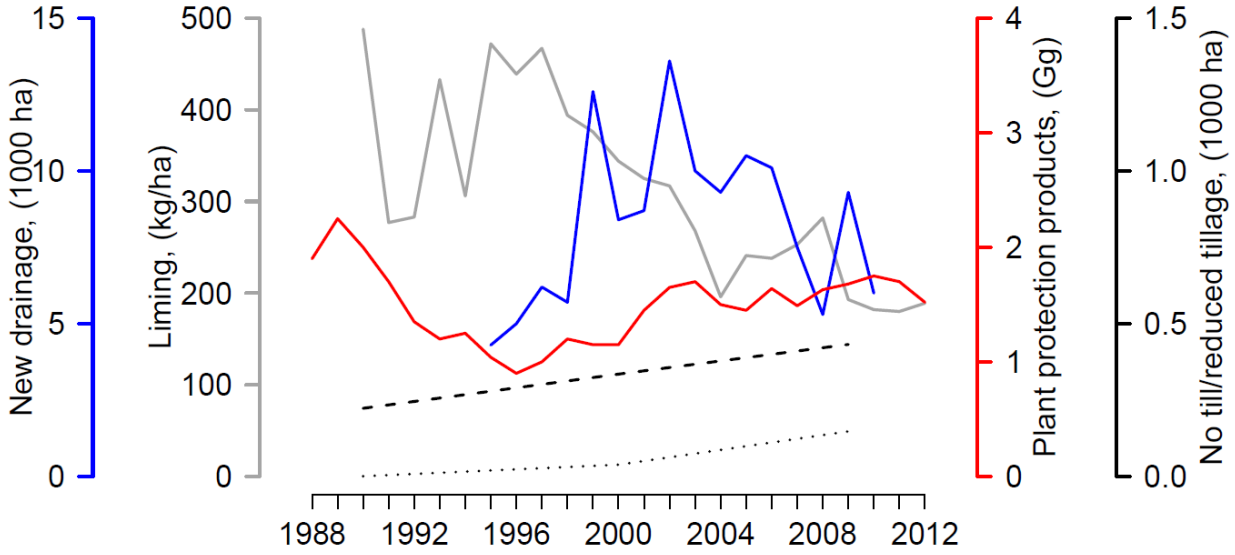

Fig. S4. National level trends in liming (grey line) (TIKE 2013), new drainage (blue line) (The Finnish Field Drainage Association: www.salaojayhdistys.fi), use of plant protection products (red line) (The Finnish Safety and Chemicals Agency, Tukes) and reduced tillage (black dashed line) and no-till (black dotted line) (Statistics Finland, 2010).

Table S1. Collection of properties of the most commonly used cultivars at the three study regions. Trends, i.e. change per year, were calculated with the start year of the cultivar testing program. Note * p < 0.05; ** p < 0.01; *** p < 0.001; p>0.05 were not notated.

	Row-type	Start year for testing program	Grain yield [kg/ha]	Days to heading	Growth duration [d]	Straw length [cm]	Lodging [%]	Ystab Yield stability	HI [%]	NUE[1] [kg grain/kg available N]	Disease susceptibility: net type net blotch [leaf area %]	Disease susceptibility: barley scald [leaf area %]
Reference	[1]	[1]	[1]	[1]	[1]	[1]	[1]	[2]	[3]	[3]	[1]	[1]
HANKKIJA-673	6-row	1970	4466	49.0	84.1	83	45	0.98	52.3	34.2	20.4	2.4
ARRA	6-row	1971	4418	48.1	83.6	83	31	0.89	49.9	32.5	16.4	2.6
HJAN POTRA	6-row	1974	4438	48.4	85.4	80	22	0.98	46.5	34.8	10.9	·
HJAN POKKO	6-row	1975	4420	51.8	89.8	80	21	1.01	50.0	34.5	12.6	3.1
KUSTAA	2-row	1976	4333	52.2	93.7	67	13	0.98	·	·	12.7	1.5
AGNETA	6-row	1978	4535	50.2	87.5	80	19	1.08	51.5	42.4	70.0	1.9
KALLE	6-row	1980	4606	49.6	87.8	83	18	0.96	·	·	60.1	4.0
KYMPPI	2-row	1981	4567	53.6	94.1	71	12	1.04	·	·	22.6	2.4
METTE	2-row	1982	4676	54.1	93.0	69	13	0.93	·	·	5.4	1.9
POHTO	6-row	1984	4864	50.6	89.3	68	23	1.04	53.4	38.9	5.4	0.7
LOVIISA	6-row	1985	4868	48.6	86.5	81	24	1.06	53.2	38.4	14.3	3.0
ARVE	6-row	1987	4844	48.4	85.1	75	14	1.01	·	·	44.4	2.2
ARTTURI	6-row	1989	4722	49.0	83.8	73	19	0.96	53.3	39.9	11.2	2.7
ROLFI	6-row	1990	4881	48.4	84.8	68	14	0.98	54.0	35.6	12.0	3.9
INARI	2-row	1991	4856	54.6	95.2	67	11	1.05	47.8	39.7	6.9	2.1
THULE	6-row	1991	4909	52.0	90.9	74	12	1.05	·	·	4.1	5.3
ERKKI	6-row	1992	5095	50.4	89.1	74	19	1.05	52.3	40.3	5.9	1.8
SAANA	2-row	1992	4708	53.8	91.9	63	6	0.82	48.1	35.6	1.4	0.5
SCARLETT	2-row	1995	5089	53.5	93.2	63	11	1.06	52.8	39.8	1.5	2.0
BARKE	2-row	1997	5193	54.3	96.1	69	10	1.03	46.6	40.1	4.0	1.5
KUNNARI	6-row	1997	5307	50.6	91.1	74	11	1.08	55.6	40.3	3.1	1.1
ANNABELL	2-row	2001	5417	55.0	96.1	67	8	1.01	50.3	44.1	1.9	2.9
GAUTE	6-row	2001	5272	51.3	88.0	76	13	0.97	·	·	11.0	2.2
VOITTO	6-row	2002	5068	48.7	85.5	74	8	0.98	53.1	40.0	29.7	2.1
Trend			29.7***	0.1	0.1	-0.4**	-0.6***	0.0	0.0	0.2**	-0.6	0.0

[1] N use efficiency

[2] Response to drought 3-7 weeks after sowing

[1] MTT official variety trial data (Kangas et al. 2010)

[2] (Peltonen-Sainio et al. 2011)

[3] Ari Rajala, personal communication 15.9.2014

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