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Supplementary Material

Assessment of drought tolerance and its potential yield penalty in potato

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Table S1. Cultivar identifier, cultivar name, breeding companies and maturity group (1 = early, 5 = late) of potato cultivars

Cultivar ID	Cultivar	Breeder	Maturity group
382	DESIREE		3
2673	ALEGRIA	NORIKA	3
2674	MILVA	BERDING	3
2675	SATURNA	EUROPLANT	3
2853	ULME	BAVARIA	5
2854	ELDENA	EUROPLANT	3
2855	EUROBRAVO	EUROPLANT	5
2856	EUROFLORA	EUROPLANT	5
2857	EURONOVA	EUROPLANT	5
2858	EURORESA	EUROPLANT	5
2859	EUROSTARCH	EUROPLANT	5
2860	EUROTANGO	EUROPLANT	5
2861	KURAS	EUROPLANT	5
2862	TOMENSA	EUROPLANT	3
2863	TOMBA	EUROPLANT	5
2864	JUMBO	FIRLBECK	3
2865	LOGO	FIRLBECK	5
2866	MAXI	FIRLBECK	5
2867	POWER	FIRLBECK	2
2868	SOMMERGOLD	FIRLBECK	3
2869	JASIA	NIEHOFF	5
2870	ALBATROS	NORIKA	3
2871	KARLENA	NORIKA	2
2872	KIEBITZ	NORIKA	2
2873	KOLIBRI	NORIKA	2
2874	KORMORAN	NORIKA	5
2875	MAXILLA	NORIKA	5
2876	PIROL	NORIKA	3
2877	BURANA	SAKA	5
2878	GOLF	SAKA	3
2879	PRIAMOS	SAKA	3
2880	RAMSES	SAKA	3
2881	SIBU	SAKA	5
2882	VERDI	SAKA	3

Table S2. Experimental design for pot (Trial-Id starts with P) and field (Trial-Id starts with F) experiments and cultivation in agricultural environments (type = A) of 34 potato cultivars (experiment F2: 30 cultivars, experiment F6: 33 cultivars)

Culture Id = reference Id in the data set. T= number of treatment levels: 1 optimal, 2 optimal and drought stress treatment, 3 optimal (50% field capacity), reduced irrigation (30% field capacity) and drought stress. n = number of replicate plots or pots per treatment, pl = number of plants per replicate. Start date = date of planting into final pot size or field, End date = date of shoot destruction. Water (control) = sum of precipitation and irrigation for control treatment in l per m² for field trials and l per pot for pot trials, water (drought) = sum of precipitation and irrigation for drought treatment. Experiment P1 and P3: means and standard deviation of irrigation (see Materials and Methods).

Trial-Id	Culture Id	Year	Location (Elevation (m a.S.)	T	n	pl	Start date	End date	Soil	Water (control)	Water (drought)
A1	47107	2011	48°54'N12°29'E (329)	1	2	20	18.04.2011	06.09.2011	L (Lö)	427	n/a
A2	47109	2011	54°04'N12°40'E (23)	1	2	16	19.04.2011	29.08.2011	sL-lS	628	n/a
A3	47110	2011	53°21'N12°29'E (80)	1	2	20	29.04.2011	22.09.2011	sL	532.2	n/a
A4	47111	2011	48°53'N13°22'E (383)	1	2	16	15.04.2011	01.09.2011	sL	379.5	n/a
A5	47112	2011	54°04'N12°20'E (37)	1	2	20	12.04.2011	27.09.2011	lS	622.7	n/a
A6	47114	2011	53°27'N08°04'E (1)	1	2	16	19.04.2011	17.09.2011	T	350.3	n/a
A7	47115	2011	48°34'N11°16'E (438)	1	2	20	11.04.2011	26.09.2011	lS	410	n/a
A8	47117	2011	54°28'N09°49'E (8)	1	2	20	11.04.2011	03.09.2011	sL-lS	551.5	n/a
A9	56876	2012	54°28'N09°49'E (8)	1	2	20	03.05.2012	05.09.2012	sL-lS	378	n/a
A10	56878	2012	48°54'N 12°29'E (329)	1	2	20	27.04.2012	10.09.2012	L (Lö)	381.1	n/a
A11	56879	2012	54°04'N12°40'E (23)	1	2	12	24.04.2012	25.08.2012	sL-lS	266	n/a
A12	56880	2012	53°21'N12°29'E (80)	1	2	20	02.05.2012	22.10.2012	sL	343.8	n/a
A13	56881	2012	48°53'N13°22'E (383)	1	2	16	30.04.2012	17.08.2012	sL	275.5	n/a
A14	56882	2012	54°04'N12°20'E (37)	1	2	20	21.04.2012	15.09.2012	lS	183.7	n/a
A15	56883	2012	53°27'N08°04'E (1)	1	2	16	30.04.2012	27.08.2012	T	249.2	n/a
A16	56884	2012	48°34'N11°16'E (438)	1	2	20	20.04.2012	27.08.2012	sL	339.4	n/a

Trial-Id	Culture Id	Year	Location	T	n	pl	Start date	End date	Soil	Water (control)	Water (drought)
F1	44443	2011	52°24'N13°04'E (31)	2	4 (8)	8	21.04.2011	01.09.2011	S	329.76	274.32
F2	46150	2011	52°57'N10°08'E (70)	3	2	31	11.04.2011	02.09.2011	lS	451	361
F3	56726	2012	52°24'N13°04'E (31)	2	4(8)	8	15.04.2012	18.08.2012	S	360.88	319.74
F4	56875	2012	54°04'N12°20'E (37)	2	2	6	19.04.2012	28.08.2012	lS	234.5	20.0
F5	56877	2012	52°57'N10°08'E (70)	3	2	31	16.04.2012	14.09.2012	lS	401.5	316.5
F4	56875	2012	54°04'N12°20'E (37)	2	2	6	19.04.2012	28.08.2012	lS	234.5	20.0
F6	62326	2013	52°24'N13°04'E (31)	2	4(8)	8	20.04.2013	09.08.2013	S	346.94	260.7
F7	62327	2013	54°04'N12°20'E (37)	2	2	6	25.04.2013	19.09.2013	lS	426.7	24.0
F8	62328	2013	52°57'N10°08'E (70)	3	2	31	20.04.2013	19.09.2013	S	521.5	346.5
P1	45990	2011	Shelter JKI	2		1	27.04.2011	15.08.2011		20.74 ± 1.86	16.43 ± 1.99
P2	56575	2012	MPIMP	2	3	2	29.02.2012	01.06.2012		20.86	8.55
P3	57803	2012	Shelter JKI	2		1	26.04.2012	09.08.2012		7.49 ± 0.6	5.44 ± 0.84
P4	58243	2012	MPIMP	2	3	2	27.06.2012	02.10.2012		17.49	7.27
P5	60319	2012	MPIMP	2	3	2	17.10.2012	24.01.2013		20.95	8.54
P6	62030	2013	MPIMP	2	3	2	13.02.2013	16.05.2013		21.68	15.51

Table S3. Parameter for the Stressmodel

S = soil quality rank, FC = field capacity, drought_Ed/Ld = drought stress score before/after flowering at sufficient water supply. drought_Ec/Lc = drought stress score before/after flowering at reduced water supply (not all experiments). Cold_E/L and heat_E/L = cold or heat stress score before/after flowering. LS = Light sum in kW/m². (Details see Material and Methods, Climate and stress effect model)

Trial-Id	Culture Id	S	FC	Drought_Ec	Drought_Lc	Drought_Ed	Drought_Ld	Cold_E	Cold_L	Heat_E	Heat_L	LS_E	LS_L
F1	44443	1	0.09	7	2	18	13	16.4	0.0	2.5	2.1	152	293
F2	46150	2	0.12	17	0	26	9	51.1	2.1	0	0	165	340
A1	47107	5	0.14	10	0			49.1	8.3	0.0	7.3	184	405
A2	47109	3	0.125	11	0			69.1	12.8	0	0	106	380
A3	47110	4	0.13	3	0			3.3	0.0	0.0	0.1	51	340
A4	47111	4	0.13	13	0			58.7	1.1	1.1	11.3	249	323
A5	47112	2	0.12	20	0			66.9	15.4	0.0	0.0	131	416
A6	47114	4	0.1	12	0			10.1	0.0	0.0	0.3	123	312
A7	47115	2	0.12	2	0			52.6	5.2	0.0	8.0	272	314
A8	47117	3	0.125	21	0			53.6	0.1	0.0	0.0	182	285
F3	56726	1	0.09	6	0	12	12	30.4	3.6	2.1	15.7	157	340
F4	56875	2	0.12	7	0	46	6	62.5	4	0	5.4	194	259
F5	56877	2	0.12	10	0	17	9	65.5	12.8	0.0	4.7	184	364
A9	56876	3	0.125	6	0			26.1	0.0	0.0	0.6	132	248
A10	56878	5	0.14	5	0			37.7	12.1	0.0	6.4	125	424
A11	56879	3	0.125	2	0			77.6	5.1	0.0	5.9	173	291
A12	56880	4	0.13	15	0			22.2	1.1	0.0	3.2	133	320
A13	56881	4	0.13	8	0			33.1	5.8	0.0	13.3	111	339
A14	56882	2	0.12	5	0			59.8	9.6	0.0	5.4	171	358
A15	56883	4	0.1	17	0			5.9	0.0	0.0	5.5	123	239
A16	56884	2	0.12	2	0			39.8	4	0	19.3	156	383
F6	62326	1	0.09	4	0	4	34	15.4	0.1	0	24.6	166	274
F7	62327	2	0.12	0	0	22	45	30.7	8.5	0	2.7	162	346
F8	62328	2	0.12	3	0	7	51	33.1	11.3	0	11.3	150	423

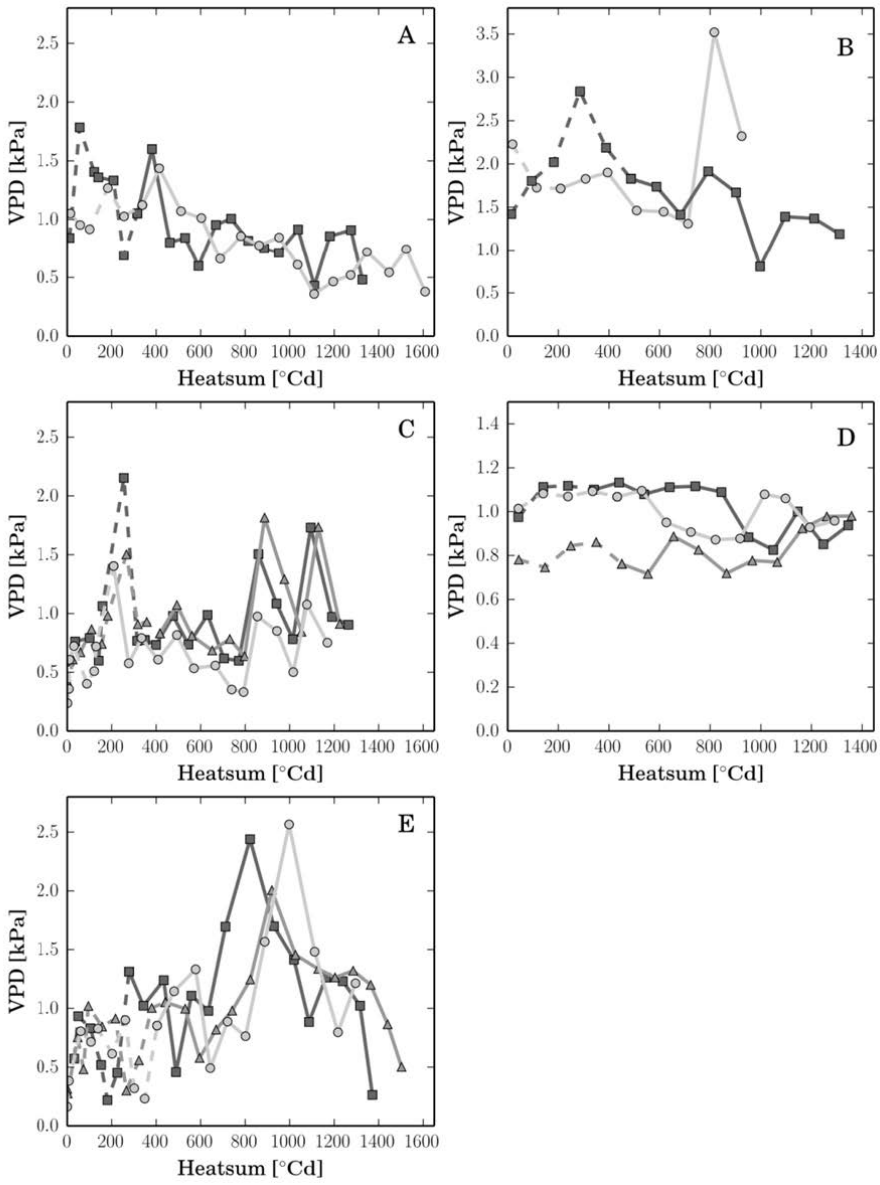

Figure S1. Characterisation of the stress regime by water pressure deficit of the air in field experiments (A (2011), C (2012) and E (2013)) and pot experiments (B (JKI), D (MPI-MP)). The average midday vapour pressure deficit in an interval of seven days is plotted against the thermal time at the end of the interval. Time before flowering is represented by dashed lines, after flowering as solid lines. Field sites were located at Potsdam-Golm (circles, light grey), Dethlingen (squares, dark grey), or Groß Lüsewitz (triangles, medium grey). Pot trials (B) were conducted in the JKI shelter in 2011 (squares, dark grey) and 2012 (circles, light grey). Pot trials (D) were conducted in a climate-controlled greenhouse at the MPI-MP between 2011 and 2013 (Trial-Id P2 (squares, dark grey), P4 (triangles, medium grey), and P5 (circles, light grey)) Note the reduced x-axis in figures B and D, representing a reduced thermal time resulting from a shorter trial period as well as lower temperatures in the climate-controlled greenhouse. Note the different ranges of VPD (as given by differently scaled y-axes) between pot and field trials.

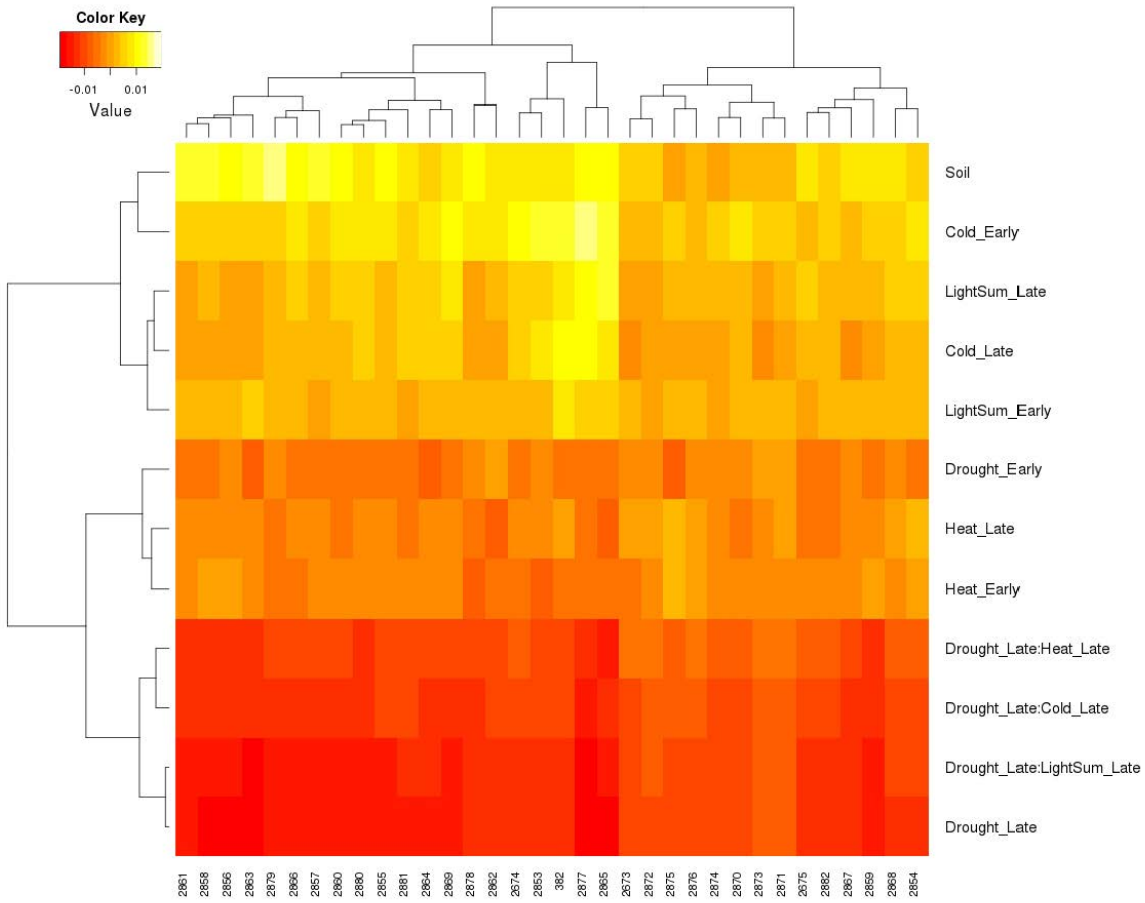

Figure S2. Heatmap of PLS-coefficients associated with the first PLS-component obtained for the regression model **Error! Reference source not found.** for the 34 cultivars specified by their identifier. The R-package heatmap.2 was used with default clustering settings.