Organic spring barley – grain yield

REML variance components analysis

Response variate:	yield/10
Fixed model:	Constant + variety
Random model:	env + env.variety + env.rep
Number of units:	800

Separate residual terms for each level of experiment factor: ss

Sparse algorithm with AI optimisation

Covariance structures defined for random model

Covariance structures defined within terms:

Term	Factor	Model	Order	No. rows
env.variety	env	Identity	0	20
	variety	Diagonal	10	10

Estimated variance components

Random term	component	s.e.
env	2.2719	0.7456
env.rep	0.0651	0.0143

Estimated parameters for covariance models

Random term(s)	Factor	Model(order)	Parameter	Estimate	s.e.
env.variety	env	Identity	-	-	-
	variety	Diagonal	d_1	0.1492	0.0582
			d_2	0.06085	0.02851
			d_3	0.1453	0.0588
			d_4	0.08331	0.03673
			d_5	0.1251	0.0511
			d_6	0.04030	0.02146
			d_7	0.1229	0.0493
			d_8	0.01033	0.01264
			d_9	0.09877	0.04206
			d_10	0.1333	0.0533

Residual model for each experiment

Experiment factor: ss

Experiment	Term	Factor	Model(order)	Parameter	Estimate	s.e.
20 Gra	Residual		Identity	Variance	0.0167	0.0045
20 Os	Residual		Identity	Variance	0.0330	0.0089

20 Sko	Residual	Identity	Variance	0.0431	0.0117
20 Sze	Residual	Identity	Variance	0.0718	0.0193
20 Tar	Residual	Identity	Variance	0.0995	0.0289
20 We	Residual	Identity	Variance	0.139	0.037
21 Gra	Residual	Identity	Variance	0.0107	0.0029
21 Os	Residual	Identity	Variance	0.0297	0.0080
21 Sko	Residual	Identity	Variance	0.0431	0.0117
21 Sze	Residual	Identity	Variance	0.154	0.041
21 Tar	Residual	Identity	Variance	0.0801	0.0212
21 We	Residual	Identity	Variance	0.0467	0.0125
22 Gra	Residual	Identity	Variance	0.0440	0.0121
22 Os	Residual	Identity	Variance	0.416	0.111
22 Prz	Residual	Identity	Variance	0.0770	0.0206
22 Ra	Residual	Identity	Variance	0.0158	0.0043
22 Sr	Residual	Identity	Variance	0.160	0.043
22 Sze	Residual	Identity	Variance	0.0415	0.0112
22 Tar	Residual	Identity	Variance	0.399	0.106
22 We	Residual	Identity	Variance	0.170	0.047

Tests for fixed effects

Sequentially adding terms to fixed model

Fixed term	Wald statistic	n.d.f.	F statistic	d.d.f.	F pr
variety	52.76	9	5.32	53.4	<0.001

Dropping individual terms from full fixed model

Fixed term	Wald statistic	n.d.f.	F statistic	d.d.f.	F pr
variety	52.76	9	5.32	53.4	<0.001

Message: denominator degrees of freedom for approximate F-tests are calculated using algebraic derivatives ignoring fixed/boundary/singular variance parameters.

Table of predicted means for Constant

4.730 Standard error: 0.3392

Table of predicted means for variety

variety	Avatar	Bente	Etoile	Farmer	KWSVermont
	4.863	4.931	4.497	4.577	4.812

variety	Mecenas	MHRFajter	Pilote	Radek	Rubaszek
	4.878	4.526	4.619	4.920	4.682

Standard errors of differences

Average:	0.1075
Maximum:	0.1303
Minimum:	0.06516

Average variance of differences: 0.01179

Fisher's unprotected least significant difference test

Comparisons between variety means

	Mean	
Bente	4.931	a
Radek	4.920	a
Mecenas	4.878	ab
Avatar	4.863	ab
KWSVermont	4.812	ab
Rubaszek	4.682	bc
Pilote	4.619	c
Farmer	4.577	c
MHRFajter	4.526	c
Etoile	4.497	c

Predictions from REML analysis

Model terms included for prediction: Constant + variety + env + env.variety + env.rep

Status of model variables in prediction:

Variable	Type	Status
variety	factor	Classifies predictions
Constant	factor	Included in prediction
env	factor	Classifies predictions
rep	factor	Averaged over - equal weights

Response variate: yield/10

Predictions

env variety	20 Gra	20 Os	20 Sko	20 Sze	20 Tar	20 We	21 Gra
Avatar	4.457	3.567	3.909	6.817	6.402	5.389	2.711
Bente	4.027	3.414	3.558	6.281	7.010	5.100	2.819
Etoile	3.901	2.473	3.113	5.404	6.363	4.263	2.699
Farmer	4.198	2.762	3.470	6.268	6.991	4.775	2.848
KWSVermont	4.123	3.318	4.095	6.053	7.274	5.137	2.569
Mecenas	4.353	3.453	3.442	6.618	6.729	5.397	2.799
MHRFajter	4.055	2.971	3.106	5.982	5.724	5.114	2.692
Pilote	4.010	3.036	3.126	6.148	6.365	4.974	2.786
Radek	4.233	3.756	3.081	6.688	6.713	5.643	2.825
Rubaszek	4.061	3.141	3.437	6.220	7.482	5.240	2.848

env variety	21 Os	21 Sko	21 Sze	21 Tar	21 We	22 Gra	22 Os
Avatar	3.212	6.952	4.069	6.211	5.115	5.370	3.066
Bente	3.433	6.335	3.874	6.830	5.553	4.898	3.620
Etoile	2.609	5.629	3.703	6.533	4.888	5.121	3.330
Farmer	2.798	5.751	3.650	6.350	4.623	4.687	3.286
KWSVermont	3.271	6.191	3.857	6.770	4.850	5.044	3.323
Mecenas	3.476	6.100	3.929	6.709	5.315	4.545	3.687
MHRFajter	3.288	5.259	3.440	6.464	5.298	5.242	3.178
Pilote	3.296	5.923	3.636	6.447	5.021	4.753	3.247
Radek	3.716	6.644	4.531	6.628	5.244	4.682	3.624
Rubaszek	3.338	5.609	3.631	6.723	5.430	4.858	3.262

env variety	22 Prz	22 Ra	22 Sr	22 Sze	22 Tar	22 We
Avatar	3.885	5.994	7.191	2.716	7.050	3.178
Bente	4.325	6.950	7.440	3.039	6.755	3.351
Etoile	4.308	5.938	7.067	2.271	7.202	3.122
Farmer	3.715	6.223	6.564	2.510	6.848	3.227
KWSVermont	4.240	5.704	7.112	2.664	7.450	3.196
Mecenas	4.387	6.628	7.113	2.614	6.948	3.325
MHRFajter	4.206	5.539	6.878	2.258	6.920	2.896
Pilote	4.095	6.158	6.970	2.618	6.709	3.062
Radek	4.096	6.311	6.903	2.845	7.022	3.209
Rubaszek	3.867	5.435	6.867	2.733	6.452	3.008

Standard errors

env variety	20 Gra	20 Os	20 Sko	20 Sze	20 Tar	20 We	21 Gra
Avatar	0.0639	0.0887	0.1005	0.1274	0.1472	0.1701	0.0513
Bente	0.0629	0.0861	0.0969	0.1204	0.1370	0.1552	0.0508
Etoile	0.0639	0.0886	0.1005	0.1272	0.1470	0.1698	0.0513
Farmer	0.0633	0.0872	0.0984	0.1233	0.1411	0.1610	0.0510
KWSVermont	0.0638	0.0883	0.1000	0.1263	0.1456	0.1677	0.0513
Mecenas	0.0622	0.0844	0.0945	0.1161	0.1309	0.1469	0.0504
MHRFajter	0.0637	0.0882	0.0999	0.1262	0.1454	0.1674	0.0513
Pilote	0.0595	0.0781	0.0861	0.1019	0.1122	0.1230	0.0490
Radek	0.0635	0.0877	0.0992	0.1246	0.1431	0.1640	0.0511
Rubaszek	0.0638	0.0884	0.1002	0.1267	0.1462	0.1686	0.0513

env variety	21 Os	21 Sko	21 Sze	21 Tar	21 We	22 Gra	22 Os
Avatar	0.0843	0.1006	0.1772	0.1338	0.1044	0.1016	0.2565
Bente	0.0821	0.0970	0.1606	0.1258	0.1004	0.0978	0.2175
Etoile	0.0843	0.1005	0.1768	0.1336	0.1043	0.1015	0.2554
Farmer	0.0830	0.0985	0.1671	0.1290	0.1021	0.0994	0.2313
KWSVermont	0.0840	0.1001	0.1744	0.1325	0.1038	0.1010	0.2491
Mecenas	0.0806	0.0946	0.1516	0.1210	0.0977	0.0954	0.2005
MHRFajter	0.0839	0.1000	0.1741	0.1324	0.1037	0.1009	0.2483
Pilote	0.0750	0.0861	0.1261	0.1053	0.0885	0.0867	0.1614
Radek	0.0835	0.0992	0.1703	0.1306	0.1029	0.1001	0.2388
Rubaszek	0.0841	0.1003	0.1754	0.1330	0.1040	0.1012	0.2518

env	22 Prz	22 Ra	22 Sr	22 Sze	22 Tar	22 We
variety						
Avatar	0.1314	0.0620	0.1799	0.0988	0.2529	0.1845
Bente	0.1238	0.0611	0.1627	0.0953	0.2150	0.1662
Etoile	0.1312	0.0620	0.1795	0.0987	0.2519	0.1841
Farmer	0.1269	0.0615	0.1694	0.0968	0.2285	0.1733
KWSVermont	0.1302	0.0619	0.1771	0.0983	0.2458	0.1815
Mecenas	0.1192	0.0605	0.1535	0.0931	0.1983	0.1565
MHRFajter	0.1301	0.0619	0.1767	0.0982	0.2451	0.1811
Pilote	0.1041	0.0580	0.1273	0.0849	0.1597	0.1294
Radek	0.1284	0.0617	0.1728	0.0975	0.2358	0.1769
Rubaszek	0.1307	0.0619	0.1781	0.0985	0.2484	0.1826

Approximate average standard error of difference: 0.1890 (calculated on variance scale)

Predictions from REML analysis

Model terms included for prediction: Constant + variety + env + env.variety + env.rep

Status of model variables in prediction:

Variable	Type	Status
variety	factor	Averaged over - equal weights
Constant	factor	Included in prediction
env	factor	Classifies predictions
rep	factor	Averaged over - equal weights

Response variate: yield/10

Predictions

env	20 Gra	20 Os	20 Sko	20 Sze	20 Tar	20 We	21 Gra	21 Os
	4.142	3.189	3.434	6.248	6.705	5.103	2.759	3.244

env	21 Sko	21 Sze	21 Tar	21 We	22 Gra	22 Os	22 Prz	22 Ra
	6.039	3.832	6.567	5.134	4.920	3.362	4.112	6.088

env	22 Sr	22 Sze	22 Tar	22 We
	7.010	2.627	6.936	3.157

Standard errors

env	20 Gra	20 Os	20 Sko	20 Sze	20 Tar
	0.02046	0.02872	0.03280	0.04236	0.04984

env	20 We	21 Gra	21 Os	21 Sko	21 Sze
	0.05900	0.01637	0.02725	0.03282	0.06196

env	21 Tar	21 We	22 Gra	22 Os	22 Prz

	0.04473	0.03414	0.03315	0.10181	0.04385

env	22 Ra	22 Sr	22 Sze	22 Tar	22 We
	0.01984	0.06314	0.03219	0.09968	0.06514

Approximate average standard error of difference: 0.07222 (calculated on variance scale)