

Supplementary Material

Wang, J.; Chen, Y.; Zhang, Y.; Zhang, Y.; Ai, Y.; Feng, Y.; Moody, D.; Diggle, A.; Damon, P.; Rengel, Z. Phenotyping and Validation of Root Morphological Traits in Barley (*Hordeum vulgare* L.). *Agronomy* **2021**, *11*

Table S1. List of 189 genotypes of barley (*Hordeum vulgare* L.), and their origins, used in this study

Code	Name	Origin*	Materials
1	IGB1320	AUS/InterGrain	Semi-advanced and parental materials
2	IGB1335T	AUS/InterGrain	Semi-advanced and parental materials
3	IGB1238	AUS/InterGrain	Semi-advanced and parental materials
4	Vlamingh	AUS/InterGrain	Semi-advanced and parental materials
5	Shepherd	AUS/InterGrain	Semi-advanced and parental materials
6	IGB1339T	AUS/InterGrain	Semi-advanced and parental materials
7	IGB1308	AUS/InterGrain	Semi-advanced and parental materials
8	IGB1217	AUS/InterGrain	Semi-advanced and parental materials
9	IGB1239	AUS/InterGrain	Semi-advanced and parental materials
10	IGB1210T	AUS/InterGrain	Semi-advanced and parental materials
11	IGB1324T	AUS/InterGrain	Semi-advanced and parental materials
12	IGB1310	AUS/InterGrain	Semi-advanced and parental materials
13	IGB1217	AUS/InterGrain	Semi-advanced and parental materials
14	Publican	Europe/Syngenta	Semi-advanced and parental materials
15	Wimmera	AUS/AVS	Cultivars
16	IGB1307	AUS/InterGrain	Semi-advanced and parental materials
17	Finders	AUS/InterGrain	Semi-advanced and parental materials
18	IGB1427T	AUS/InterGrain	Semi-advanced and parental materials
19	IGB1426T	AUS/InterGrain	Semi-advanced and parental materials
20	IGB1327T	AUS/InterGrain	Semi-advanced and parental materials
21	IGB1305	AUS/InterGrain	Semi-advanced and parental materials
22	Latrobe	AUS/AVS	Cultivars
23	IGB1304	AUS/InterGrain	Semi-advanced and parental materials
24	Grout	AUS/DAFQ	Cultivars
25	Fathom	AUS/AU	Cultivars
26	IGB1431T	AUS/InterGrain	Semi-advanced and parental materials
27	Mundah	AUS/DAFWA	Cultivars
28	IGB1211	AUS/InterGrain	Semi-advanced and parental materials
29	IGB1432T	AUS/InterGrain	Semi-advanced and parental materials
30	IGB1329T	AUS/InterGrain	Semi-advanced and parental materials
31	IGB1469	AUS/InterGrain	Semi-advanced and parental materials
32	IGB1240	AUS/InterGrain	Semi-advanced and parental materials
33	Baudin	AUS/InterGrain	Semi-advanced and parental materials
34	Forensic	Europe/Syngenta	Cultivars
35	IGB1338T	AUS/InterGrain	Semi-advanced and parental materials

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Table S1. Continued

Code	Name	Origin	Materials
36	Henley	Europe/Limagrain	Cultivars
37	IGB1140	AUS/InterGrain	Semi-advanced and parental materials
38	IGB1418T	AUS/InterGrain	Semi-advanced and parental materials
39	Skipper	AUS/AU	Cultivars
40	Oxford	Europe/Limagrain	Cultivars
41	IGB1309	AUS/InterGrain	Semi-advanced and parental materials
42	IGB1332	AUS/InterGrain	Semi-advanced and parental materials
43	IGB1323T	AUS/InterGrain	Semi-advanced and parental materials
44	IGB1333T	AUS/InterGrain	Semi-advanced and parental materials
45	IGB1422T	AUS/InterGrain	Semi-advanced and parental materials
46	IGB1419T	AUS/InterGrain	Semi-advanced and parental materials
47	IGB1412	AUS/InterGrain	Semi-advanced and parental materials
48	IGB1425T	AUS/InterGrain	Semi-advanced and parental materials
49	IGB1416T	AUS/InterGrain	Semi-advanced and parental materials
50	IGB1322T	AUS/InterGrain	Semi-advanced and parental materials
51	IGB1315	AUS/InterGrain	Semi-advanced and parental materials
52	Quench	Europe/Syngenta	Cultivars
53	IGB1303	AUS/InterGrain	Semi-advanced and parental materials
54	IGB1418T	AUS/InterGrain	Semi-advanced and parental materials
55	Gairdner	AUS/DAFWA	Cultivars
56	IGB1321T	AUS/InterGrain	Semi-advanced and parental materials
57	Buloke	AUS/AVS	Cultivars
58	IGB1456	AUS/InterGrain	Semi-advanced and parental materials
59	IGB1428T	AUS/InterGrain	Semi-advanced and parental materials
60	Scope	AUS/AVS	Cultivars
61	IGB1404	AUS/InterGrain	Semi-advanced and parental materials
62	IGB1311	AUS/InterGrain	Semi-advanced and parental materials
63	IGB1317	AUS/InterGrain	Semi-advanced and parental materials
64	IGB1331	AUS/InterGrain	Semi-advanced and parental materials
65	IGB1316	AUS/InterGrain	Semi-advanced and parental materials
66	IGB1429T	AUS/InterGrain	Semi-advanced and parental materials
67	IGB1467	AUS/InterGrain	Semi-advanced and parental materials
68	IGB1235	AUS/InterGrain	Semi-advanced and parental materials
69	IGB1406	AUS/InterGrain	Semi-advanced and parental materials
70	IGB1414T	AUS/InterGrain	Semi-advanced and parental materials

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Table S1. Continued

Code	Name	Origin*	Materials
71	IGB1413T	AUS/InterGrain	Semi-advanced and parental materials
72	IGB1301	AUS/InterGrain	Semi-advanced and parental materials
73	IGB1463	AUS/InterGrain	Semi-advanced and parental materials
74	IGB1212T	AUS/InterGrain	Semi-advanced and parental materials
75	IGB1312	AUS/InterGrain	Semi-advanced and parental materials
76	IGB1302	AUS/InterGrain	Semi-advanced and parental materials
77	IGB1326T	AUS/InterGrain	Semi-advanced and parental materials
78	IGB1337T	AUS/InterGrain	Semi-advanced and parental materials
79	Commander	AUS/AU	Cultivars
80	IGB1139	AUS/InterGrain	Semi-advanced and parental materials
81	IGB1328T	AUS/InterGrain	Semi-advanced and parental materials
82	IGB1325T	AUS/InterGrain	Semi-advanced and parental materials
83	Bass	AUS/InterGrain	Semi-advanced and parental materials
84	IGB1214T	AUS/InterGrain	Semi-advanced and parental materials
85	IGB1424T	AUS/InterGrain	Semi-advanced and parental materials
86	IGB1336T	AUS/InterGrain	Semi-advanced and parental materials
87	IGB1319	AUS/InterGrain	Semi-advanced and parental materials
88	IGB1330T	AUS/InterGrain	Semi-advanced and parental materials
89	Propino	Europe/Syngenta	Cultivars
90	IGB1334T	AUS/InterGrain	Semi-advanced and parental materials
91	06S334-29	AUS/InterGrain	Semi-advanced and parental materials
92	07S462-65	AUS/InterGrain	Semi-advanced and parental materials
93	07S539-39	AUS/InterGrain	Semi-advanced and parental materials
94	07S543-106	AUS/InterGrain	Semi-advanced and parental materials
95	08S846-016	AUS/InterGrain	Semi-advanced and parental materials
96	09S526-119	AUS/InterGrain	Semi-advanced and parental materials
97	10M73SD-061	AUS/InterGrain	Semi-advanced and parental materials
98	10S692N-11	AUS/InterGrain	Semi-advanced and parental materials
99	10S692N-157	AUS/InterGrain	Semi-advanced and parental materials
100	10S692N-236	AUS/InterGrain	Semi-advanced and parental materials
101	10S770D-149	AUS/InterGrain	Semi-advanced and parental materials
102	10S881N-107	AUS/InterGrain	Semi-advanced and parental materials
103	10S881N-141	AUS/InterGrain	Semi-advanced and parental materials
104	10S881N-298	AUS/InterGrain	Semi-advanced and parental materials
105	10S881N-40S	AUS/InterGrain	Semi-advanced and parental materials

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Table S1. Continued

Code	Name	Origin	Materials
106	10S881N-421	AUS/InterGrain	Semi-advanced and parental materials
107	10S881N-421	AUS/InterGrain	Semi-advanced and parental materials
108	11M014-013-011	AUS/InterGrain	Semi-advanced and parental materials
109	11M048HT-019F4	AUS/InterGrain	Semi-advanced and parental materials
110	Compass	AUS/AU	Cultivars
111	ETH295B	Ethiopia/Landrace	Cultivars
112	Gamer	Europe/Syngenta	Cultivars
113	IGB1501	AUS/InterGrain	Semi-advanced and parental materials
114	IGB1502	AUS/InterGrain	Semi-advanced and parental materials
115	IGB1503	AUS/InterGrain	Semi-advanced and parental materials
116	IGB1504	AUS/InterGrain	Semi-advanced and parental materials
117	IGB1505	AUS/InterGrain	Semi-advanced and parental materials
118	IGB1506	AUS/InterGrain	Semi-advanced and parental materials
119	IGB1507	AUS/InterGrain	Semi-advanced and parental materials
120	IGB1508	AUS/InterGrain	Semi-advanced and parental materials
121	IGB1509	AUS/InterGrain	Semi-advanced and parental materials
122	IGB1510	AUS/InterGrain	Semi-advanced and parental materials
123	IGB1511	AUS/InterGrain	Semi-advanced and parental materials
124	IGB1512	AUS/InterGrain	Semi-advanced and parental materials
125	IGB1513	AUS/InterGrain	Semi-advanced and parental materials
126	IGB1514	AUS/InterGrain	Semi-advanced and parental materials
127	IGB1515	AUS/InterGrain	Semi-advanced and parental materials
128	IGB1516	AUS/InterGrain	Semi-advanced and parental materials
129	IGB1517	AUS/InterGrain	Semi-advanced and parental materials
130	IGB1519	AUS/InterGrain	Semi-advanced and parental materials
131	IGB1520	AUS/InterGrain	Semi-advanced and parental materials
132	IGB1521	AUS/InterGrain	Semi-advanced and parental materials
133	IGB1522	AUS/InterGrain	Semi-advanced and parental materials
134	IGB1524	AUS/InterGrain	Semi-advanced and parental materials
135	IGB1525	AUS/InterGrain	Semi-advanced and parental materials
136	IGB1526	AUS/InterGrain	Semi-advanced and parental materials
137	IGB1527	AUS/InterGrain	Semi-advanced and parental materials
138	IGB1528	AUS/InterGrain	Semi-advanced and parental materials
139	IGB1529	AUS/InterGrain	Semi-advanced and parental materials
140	IGB1530	AUS/InterGrain	Semi-advanced and parental materials

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Table S1. Continued

Code	Name	Origin	Materials
141	IGB1531	AUS/InterGrain	Semi-advanced and parental materials
142	IGB1532	AUS/InterGrain	Semi-advanced and parental materials
143	IGB1550	AUS/InterGrain	Semi-advanced and parental materials
144	IGB1551	AUS/InterGrain	Semi-advanced and parental materials
145	IGB1552	AUS/InterGrain	Semi-advanced and parental materials
146	IGB1553	AUS/InterGrain	Semi-advanced and parental materials
147	IGB1554	AUS/InterGrain	Semi-advanced and parental materials
148	IGB1555	AUS/InterGrain	Semi-advanced and parental materials
149	IGB1556	AUS/InterGrain	Semi-advanced and parental materials
150	IGB1557	AUS/InterGrain	Semi-advanced and parental materials
151	IGB1558	AUS/InterGrain	Semi-advanced and parental materials
152	IGB1559	AUS/InterGrain	Semi-advanced and parental materials
153	IGB1560	AUS/InterGrain	Semi-advanced and parental materials
154	IGB1561	AUS/InterGrain	Semi-advanced and parental materials
155	IGB1562	AUS/InterGrain	Semi-advanced and parental materials
156	IGB1563	AUS/InterGrain	Semi-advanced and parental materials
157	IGB1564	AUS/InterGrain	Semi-advanced and parental materials
158	IGB1565	AUS/InterGrain	Semi-advanced and parental materials
159	IGB1566	AUS/InterGrain	Semi-advanced and parental materials
160	IGB1567	AUS/InterGrain	Semi-advanced and parental materials
161	IGB1568	AUS/InterGrain	Semi-advanced and parental materials
162	IGB1569	AUS/InterGrain	Semi-advanced and parental materials
163	IGB1570	AUS/InterGrain	Semi-advanced and parental materials
164	IGB1571	AUS/InterGrain	Semi-advanced and parental materials
165	IGB1572	AUS/InterGrain	Semi-advanced and parental materials
166	IGB1573	AUS/InterGrain	Semi-advanced and parental materials
167	IGB1574	AUS/InterGrain	Semi-advanced and parental materials
168	IGB1575	AUS/InterGrain	Semi-advanced and parental materials
169	Lx09.76-022	AU/USyd	Cultivars
170	Lx09.83-019	AU/USyd	Cultivars
171	Lx09.98-003	AU/USyd	Cultivars
172	NRB120142-007	AU/DAFQ	Advanced breeding
173	NRB120444-007	AU/DAFQ	Advanced breeding
174	NRB120562	AU/DAFQ	Advanced breeding
175	NRB120579-008	AU/DAFQ	Advanced breeding

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Table S1. Continued

Code	Name	Origin	Materials
176	NRB120766-006	AU/DAFQ	Advanced breeding
177	NRB120772-012	AU/DAFQ	Advanced breeding
178	NRB120917-008	AU/DAFQ	Advanced breeding
179	Sloop_VIC	AU/AVS	Cultivars
180	SYN411-291-1	Europe/Syngenta	Cultivars
181	SYN411-292-2	Europe/Syngenta	Cultivars
182	SYN412-304-2	Europe/Syngenta	Cultivars
183	SYN412-308-2	Europe/Syngenta	Cultivars
184	SYN412-312-1	Europe/Syngenta	Cultivars
185	SYN412-328	Europe/Syngenta	Cultivars
186	SYN413-365	Europe/Syngenta	Cultivars
187	SYN6615-07-1	Europe/Syngenta	Cultivars
188	VB0611	AUS/AVS	Cultivars
189	VB0916	AUS/AVS	Cultivars

- Region/Breeding Organisation. Abbreviations: AUS = Australia, AVS = Agriculture Victoria Services, AU = Adelaide University, DAFQ = Department of Agriculture and Fisheries Queensland, USyd = University of Sydney, DAFWA = Department of Agriculture and Food Western Australia

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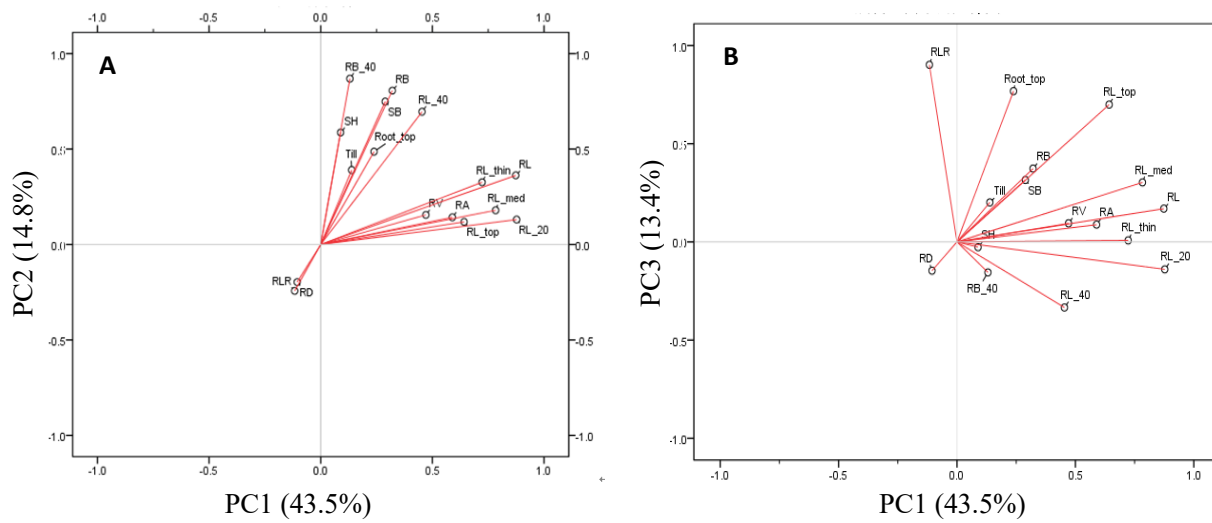


Figure S1. Principal component analysis showing the variation of 16 traits in barley germplasm grown in the semi-hydroponic phenotyping system. The position of each trait in 2-D plots is shown for principal component PC2 vs. PC1 presenting 58.3% (A), and PC3 vs. PC1 presenting 56.9% of the total variation (B).

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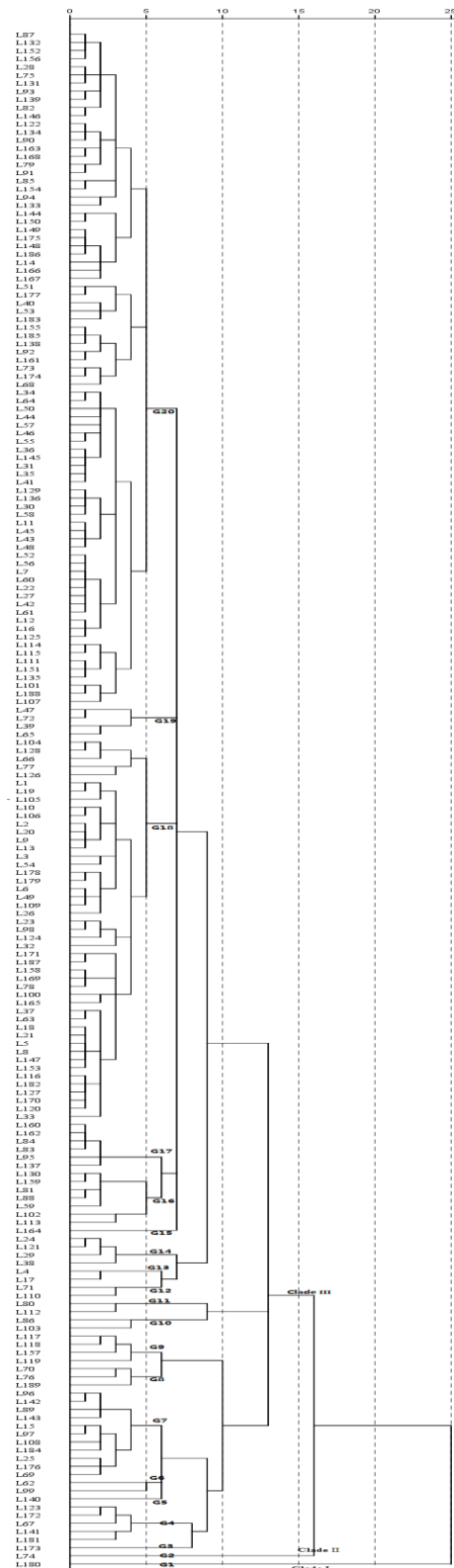


Figure S2. Dendrogram of Agglomerative Hierarchical Clustering (AHC) using the Pearson correlation coefficients (>0.25) selected from 26 root and shoot traits tested. The 189 genotypes were assigned into one of three general groups (Clade I to Clade III) at rescaled distance of 15.

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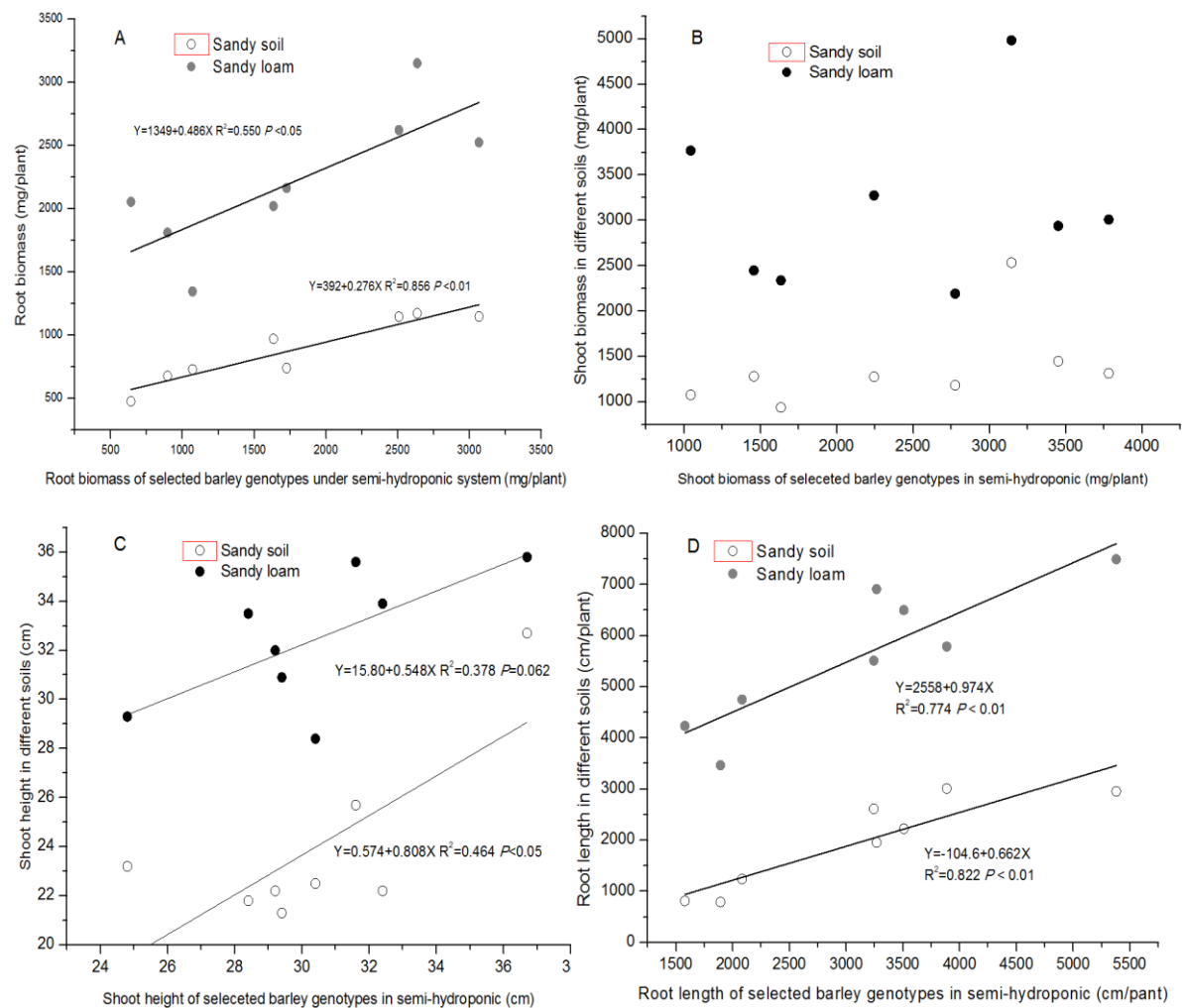


Figure S3. Correlations of root biomass (A), shoot biomass (B), shoot height (C) and root length (D) of barley genotypes grown in the semi-hydroponic system vs. the two soils (sandy soil and sandy loam).

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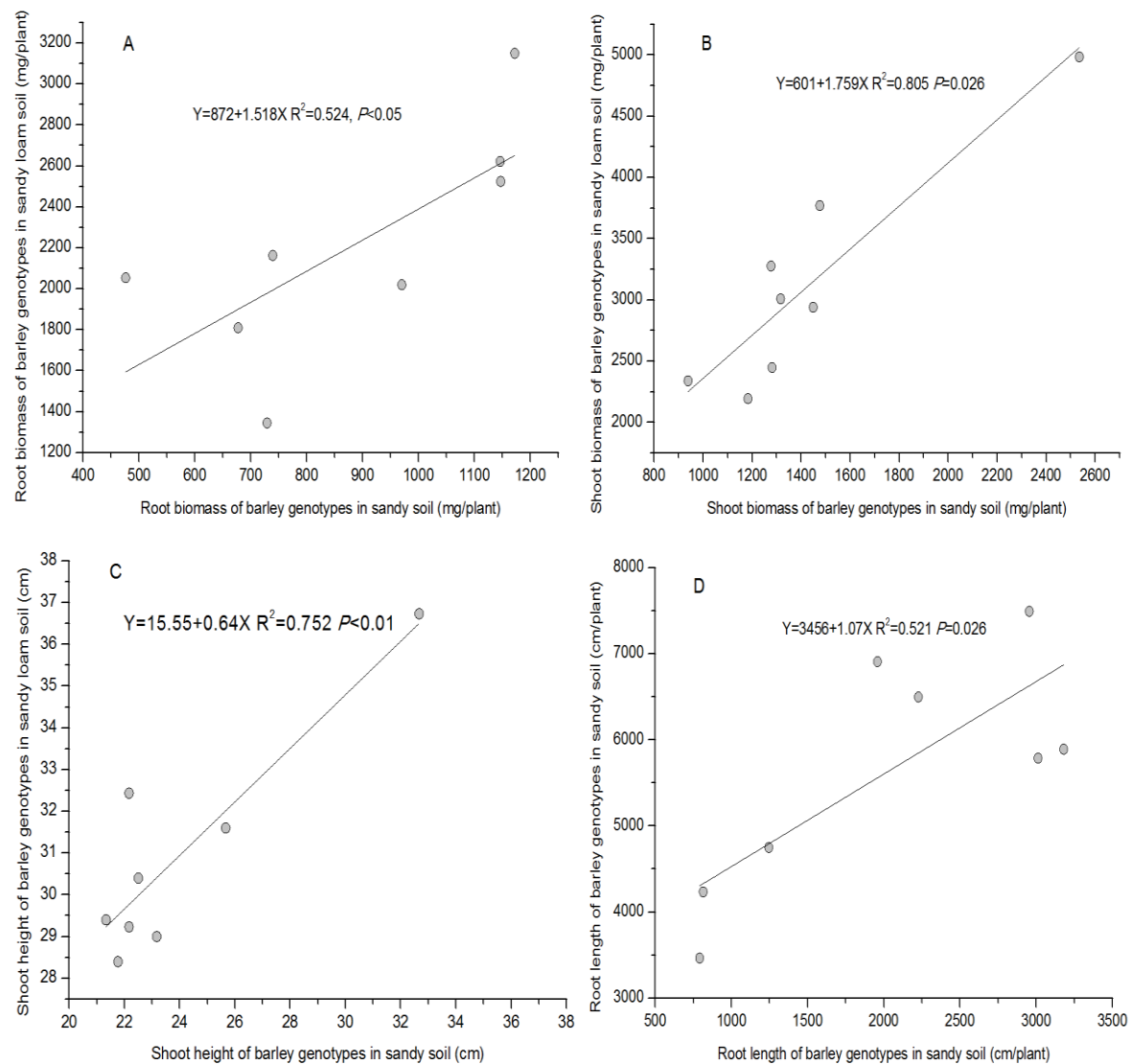


Figure S4. Correlations of root biomass (A), shoot biomass (B), shoot height (C) and root length (D) of barley genotypes grown in sandy soil vs. sandy loam.