

Supplementary Material

Tab. S1 - Overview of provenances tested in the trials and background information.(*): Registration terminated in the Dutch national register of approved material

Provenance	Provenance ID	Species	Category	Basic material	Lat	Long
Aalten-01	252	<i>Alnus glutinosa</i>	Selected (S)	seed stand	51.956	6.59
Anloo-01	268	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	53.027	6.675
Bergen-01	260	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.579	6.065
Denekamp-02	254	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.387	6.918
Denekamp-01	250	<i>Alnus glutinosa</i>	Tested (T)	seed stand	52.373	6.986
Diever-01*	273	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.837	6.206
Enschede-01	251	<i>Alnus glutinosa</i>	Selected (S)	seed stand	52.24	6.973
Grubbenvorst-02	261	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.468	6.13
Haelen-01	262	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.25	5.946
Havelte-01	274	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.808	6.296
Heythuysen-01	263	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.254	5.934
Maasbree-01	264	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.344	6.026
Nieuw-Ginneken-01	256	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.498	4.8
Norg-01	275	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	53.056	6.413
Oosterhesselen-01	269	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.771	6.724
Oosterhesselen-02	270	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.741	6.678
Rijsbergen-01	257	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.452	4.689
Ruinen-01	271	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.773	6.325
Sprang-Capelle-01	259	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.687	4.971
St. Odiliënberg-01	265	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.149	5.991
Steenbergen-01	255	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.56	4.309
Vlodrop-01	266	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.149	6.159
Westerbork-01	272	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.812	6.605
Winterswijk-02	253	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.943	6.703
Wittem-01*	267	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	50.812	5.98
Zundert-01	258	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.442	4.658
Rolde-01	276	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.948	6.574
Westvoorne-01	277	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.852	4.074
Vlist-01	278	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	51.981	4.787
Aalsmeer-01*	279	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.29	4.79
s-graveland	280	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.256	5.10
Kamerik-01	281	<i>Alnus glutinosa</i>	Source identified (SI)	seed stand	52.126	4.86
Beilen-01	413	<i>Betula pubescens</i>	Source identified (SI)	seed stand	52.77	6.51
Breda-01	407	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.54	4.731
Grubbenvorst-01	411	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.47	6.128
Haelen-01*	410	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.254	5.95
Heythuysen-01*	412	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.253	5.934

Provenance	Provenance ID	Species	Category	Basic material	Lat	Long
Rijsbergen-01	409	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.453	4.691
Rolde-01	414	<i>Betula pubescens</i>	Source identified (SI)	seed stand	52.97	6.599
Ruinen-01	415	<i>Betula pubescens</i>	Source identified (SI)	seed stand	52.773	6.325
Ruinen-02	416	<i>Betula pubescens</i>	Source identified (SI)	seed stand	52.778	6.297
Steenbergen-01	406	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.561	4.307
Wildveld-01 (seed harvest 2004)	403	<i>Betula pubescens</i>	Qualified (Q)	Seed orchard	53.153	6.156
Wildveld-01 (seed harvest 2005)	404	<i>Betula pubescens</i>	Qualified (Q)	Seed orchard	53.153	6.156
Zundert-01	408	<i>Betula pubescens</i>	Source identified (SI)	seed stand	51.442	4.658
Zweeloo-01	405	<i>Betula pubescens</i>	Selected (S)	seed stand	52.778	6.672
Ede-02	182	<i>Fagus sylvatica</i>	Selected (S)	seed stand	52.052	5.682
Park 't Loo-03*	179	<i>Fagus sylvatica</i>	Selected (S)	seed stand	52.232	5.948
Princenhage-01	183	<i>Fagus sylvatica</i>	Selected (S)	seed stand	51.586	4.712
Princenhage-02	184	<i>Fagus sylvatica</i>	Selected (S)	seed stand	51.581	4.708
Princenhage-03	185	<i>Fagus sylvatica</i>	Selected (S)	seed stand	51.576	4.701
Princenhage-04	186	<i>Fagus sylvatica</i>	Selected (S)	seed stand	51.578	4.692
Renswoude-01	181	<i>Fagus sylvatica</i>	Selected (S)	seed stand	52.072	5.526
Apeldoorn-01*	187	<i>Fagus sylvatica</i>	Source identified (SI)	seed stand	52.229	5.815
Ermelo-01	188	<i>Fagus sylvatica</i>	Source identified (SI)	seed stand	52.254	5.702
Nunspeet-01	189	<i>Fagus sylvatica</i>	Source identified (SI)	seed stand	52.289	5.812
Barneveld-01*	180	<i>Fagus sylvatica</i>	Tested (T)	seed stand	52.146	5.595
Park 't Loo-01*	177	<i>Fagus sylvatica</i>	Tested (T)	seed stand	52.232	5.943
Park 't Loo-02	178	<i>Fagus sylvatica</i>	Tested (T)	seed stand	52.229	5.945
Baarle-Nassau-01*	269	<i>Quercus robur</i>	Source identified (SI)	seed stand	51.412	4.863
Ede-01	261	<i>Quercus robur</i>	Tested (T)	seed stand	52.046	5.606
Gieten-01	272	<i>Quercus robur</i>	Source identified (SI)	seed stand	53.015	6.757
Losser-01	268	<i>Quercus robur</i>	Source identified (SI)	seed stand	52.322	6.948
Norg-01	273	<i>Quercus robur</i>	Source identified (SI)	seed stand	53.107	6.443
Norg-02	274	<i>Quercus robur</i>	Source identified (SI)	seed stand	53.102	6.444
Nunspeet-01	264	<i>Quercus robur</i>	Selected (S)	seed stand	52.381	5.79
Princenhage-04	265	<i>Quercus robur</i>	Selected (S)	seed stand	51.583	4.696
Renswoude-01	262	<i>Quercus robur</i>	Tested (T)	seed stand	52.071	5.555
Roerdalen-01	271	<i>Quercus robur</i>	Source identified (SI)	seed stand	51.173	6.116
Udenhout-01*	270	<i>Quercus robur</i>	Source identified (SI)	seed stand	51.641	5.149
Vries-02	275	<i>Quercus robur</i>	Source identified (SI)	seed stand	53.056	6.537
Winterswijk-01	266	<i>Quercus robur</i>	Source identified (SI)	seed stand	51.93	6.729
Winterswijk-02	267	<i>Quercus robur</i>	Source identified (SI)	seed stand	51.934	6.735
Zeist-01	263	<i>Quercus robur</i>	Selected (S)	seed stand	52.072	5.225
Zevenaar-02	260	<i>Quercus robur</i>	Tested (T)	seed stand	51.906	6.123

Tab. S2 - Estimates of provenance values (adjusted means) for *Alnus glutinosa*. Adjusted means having the same letter are not significantly different (P<0.05). (*): Higher values mean earlier flushing.

Prov. ID	cat.	Budburst5*	Budburst6*	Budburst8*	Diameter11 (cm)	Height11 (m)	Straightness14	Forks14	Survival14
250	T	4.22 ^a	4.23 ^{abcde}	2.91 ^a	7.94 ^a	10.07 ^a	3.65 ^a	4.58 ^{abc}	0.76 ^a
251	S	4.4 ^a	4.13 ^{abcde}	3.14 ^a	8.44 ^a	10.36 ^a	3.55 ^{ab}	4.65 ^{ab}	0.79 ^a
252	S	4.08 ^a	4.17 ^{abcde}	3.25 ^a	9.11 ^a	10.75 ^a	3.35 ^{abc}	4.37 ^{abcd}	0.7 ^a
253	SI	4.29 ^a	4.2 ^{abcde}	3.23 ^a	8.53 ^a	10.5 ^a	3.39 ^{abc}	4.25 ^{bcd}	0.86 ^a
254	SI	4.1 ^a	4.26 ^{abcde}	2.77 ^a	8.32 ^a	10.43 ^a	3.55 ^{ab}	4.28 ^{abcd}	0.82 ^a
255	SI	4.24 ^a	4.22 ^{abcde}	3.25 ^a	8.59 ^a	10.13 ^a	2.98 ^{bc}	4.25 ^{bcd}	0.71 ^a
256	SI	4.31 ^a	4.41 ^{abc}	3.1 ^a	8.65 ^a	10.37 ^a	3.23 ^{abc}	4.64 ^{ab}	0.72 ^a
257	SI	4.01 ^a	4.15 ^{abcde}	2.94 ^a	8.53 ^a	10.08 ^a	3.25 ^{abc}	4.47 ^{abc}	0.67 ^a
258	SI	3.95 ^a	4.36 ^{abcd}	2.83 ^a	8.47 ^a	10.75 ^a	3.19 ^{abc}	4.29 ^{abcd}	0.9 ^a
259	SI	4.32 ^a	4.27 ^{abcde}	3.12 ^a	8.09 ^a	10.15 ^a	2.91 ^c	4.23 ^{bcd}	0.74 ^a
260	SI	4.36 ^a	4.58 ^a	2.97 ^a	8.35 ^a	10.63 ^a	3.4 ^{abc}	4.51 ^{abc}	0.65 ^a
261	SI	4.11 ^a	4.32 ^{abcde}	2.84 ^a	8.48 ^a	10.08 ^a	3.35 ^{abc}	4.44 ^{abcd}	0.77 ^a
262	SI	4.34 ^a	4.49 ^{ab}	3 ^a	8.79 ^a	10.12 ^a	3.25 ^{abc}	4.24 ^{bcd}	0.86 ^a
263	SI	4.2 ^a	4.19 ^{abcde}	3.04 ^a	8.75 ^a	10.08 ^a	3.24 ^{abc}	4.48 ^{abc}	0.74 ^a
264	SI	4.23 ^a	4.39 ^{abc}	3.36 ^a	8.79 ^a	10.43 ^a	3.19 ^{abc}	4.46 ^{abc}	0.64 ^a
265	SI	4.38 ^a	4.34 ^{abcde}	2.89 ^a	8.89 ^a	10.22 ^a	3.43 ^{abc}	4.82 ^a	0.56 ^a
266	SI	4.07 ^a	4.08 ^{abcdef}	3.13 ^a	9.24 ^a	10.56 ^a	3.55 ^{ab}	4.36 ^{abcd}	0.6 ^a
267	SI	4.32 ^a	4.41 ^{abc}	3.21 ^a	8.74 ^a	10.47 ^a	3.08 ^{abc}	4.42 ^{abcd}	0.6 ^a
268	SI	4.1 ^a	4.17 ^{abcde}	2.52 ^a	7.86 ^a	9.56 ^a	3.15 ^{abc}	4.04 ^{cd}	0.78 ^a
269	SI	3.86 ^a	4.02 ^{abcdef}	2.81 ^a	8.75 ^a	10.26 ^a	3.26 ^{abc}	4.66 ^{ab}	0.74 ^a
270	SI	3.72 ^a	3.88 ^{bcdef}	2.44 ^a	8.71 ^a	10.25 ^a	3.62 ^a	4.3 ^{abcd}	0.71 ^a
271	SI	3.98 ^a	3.71 ^{ef}	2.43 ^a	8.01 ^a	9.86 ^a	2.89 ^c	3.89 ^d	0.68 ^a
272	SI	3.97 ^a	3.48 ^f	2.77 ^a	8.85 ^a	10.63 ^a	3.26 ^{abc}	4.39 ^{abcd}	0.62 ^a
273	SI	3.87 ^a	3.73 ^{def}	2.74 ^a	7.95 ^a	9.58 ^a	3.45 ^{abc}	4.34 ^{abcd}	0.67 ^a
274	SI	4.27 ^a	4.13 ^{abcde}	2.84 ^a	7.99 ^a	10.14 ^a	3.41 ^{abc}	4.32 ^{abcd}	0.72 ^a
275	SI	4.02 ^a	3.78 ^{cdef}	2.59 ^a	8.8 ^a	10.06 ^a	3.24 ^{abc}	4.57 ^{abc}	0.71 ^a
276	SI	4.15 ^a	4.27 ^{abcde}	2.67 ^a	7.74 ^a	9.8 ^a	3.35 ^{abc}	4.34 ^{abcd}	0.65 ^a
277	SI	4.13 ^a	4.03 ^{abcdef}	3.17 ^a	8.95 ^a	10.94 ^a	3.26 ^{abc}	4.41 ^{abcd}	0.92 ^a
278	SI	4.34 ^a	4.44 ^{ab}	2.98 ^a	8.73 ^a	10.37 ^a	3.01 ^{bc}	4.59 ^{abc}	0.73 ^a
279	SI	4.14 ^a	4.24 ^{abcde}	3.12 ^a	9.02 ^a	10.65 ^a	3.09 ^{abc}	4.41 ^{abcd}	0.77 ^a
280	SI	4.24 ^a	4.14 ^{abcde}	3.27 ^a	8.62 ^a	10.6 ^a	3.07 ^{abc}	4.57 ^{abc}	0.67 ^a
281	SI	4.17 ^a	4.46 ^{ab}	3.17 ^a	8.6 ^a	10.59 ^a	3.26 ^{abc}	4.6 ^{abc}	0.79 ^a
Mean		4.15	4.18	2.95	8.54	10.3	3.28	4.41	0.73

Tab. S3 - Estimates of provenance values (adjusted means) for *Betula pubescens*. Adjusted means having the same letter are not significantly different ($P < 0.05$). (*): Higher values mean earlier flushing.

Prov. ID	Cat.	Budburst6*	Budburst7*	Budburst8*	Height12 (m)	Diameter12 (cm)	Straightness14	Forks14	Survival14
403	Q	4.58 ^a	4.41 ^a	3.54 ^{abc}	5.6 ^c	7.47 ^d	2.98 ^a	4.11 ^a	0.35 ^a
404	Q	3.49 ^a	3.33 ^c	3.13 ^{bc}	6.54 ^c	7.93 ^{cd}	2.58 ^a	4.2 ^a	0.53 ^a
405	S	4.19 ^a	3.74 ^{bcde}	3.39 ^{abc}	6.5 ^c	8.08 ^{cd}	2.92 ^a	4.22 ^a	0.45 ^a
406	SI	3.7 ^a	3.55 ^{cde}	3.37 ^{abc}	6.24 ^c	8.57 ^{cd}	2.64 ^a	4.26 ^a	0.66 ^a
407	SI	3.34 ^a	3.46 ^{cde}	3.03 ^c	6.98 ^{bc}	8.98 ^{bc}	2.79 ^a	4.24 ^a	0.43 ^a
408	SI	3.17 ^a	3.4 ^{de}	3.05 ^{bc}	8.86 ^{ab}	10.12 ^{ab}	2.73 ^a	4.23 ^a	0.68 ^a
409	SI	3.64 ^a	3.48 ^{cde}	3.11 ^{bc}	6.25 ^c	8.13 ^{cd}	2.93 ^a	3.69 ^a	0.42 ^a
410	SI	3.47 ^a	4.3 ^{ab}	3.47 ^{abc}	10.81 ^a	11.29 ^a	2.85 ^a	4.04 ^a	0.68 ^a
411	SI	3.39 ^a	4.04 ^{abc}	3.68 ^{ab}	10.33 ^a	10.88 ^a	3.05 ^a	4.55 ^a	0.5 ^a
412	SI	3.24 ^a	3.92 ^{abcde}	3.38 ^{abc}	9.93 ^a	11.37 ^a	2.78 ^a	4.3 ^a	0.7 ^a
413	SI	3.53 ^a	3.54 ^{cde}	3.3 ^{abc}	6.38 ^c	8.32 ^{cd}	3.12 ^a	4.33 ^a	0.23 ^a
414	SI	4.15 ^a	3.95 ^{abcd}	3.61 ^{abc}	6.95 ^{bc}	8.57 ^{cd}	2.9 ^a	4.44 ^a	0.36 ^a
415	SI	4.41 ^a	4.31 ^{ab}	3.85 ^a	6.39 ^c	7.97 ^{cd}	2.77 ^a	3.86 ^a	0.26 ^a
416	SI	3.93 ^a	3.51 ^{cde}	3.2 ^{bc}	6.44 ^c	8.78 ^{bcd}	2.65 ^a	4.32 ^a	0.54 ^a
<i>Mean</i>		3.73	3.78	3.37	7.44	9.03	2.84	4.2	0.48

Tab. S4 - Estimates of provenance values (adjusted means) for *Fagus sylvatica*. Adjusted means having the same letter are not significantly different ($P < 0.05$). (*): Higher values mean earlier flushing.

Prov. ID	cat.	Budburst4*	Budburst5*	Height10 (m)	Diameter10 (cm)	Straightness11	Forks11	Survival11
177	T	2.39 ^{cd}	2.44 ^{cd}	6.06 ^a	5.98 ^a	2.84 ^a	2.6 ^{ab}	0.94 ^a
178	T	1.91 ^{ef}	1.97 ^{ef}	6.19 ^a	5.93 ^a	2.56 ^a	2.05 ^b	0.92 ^a
179	S	2.24 ^{de}	2.34 ^{de}	5.73 ^a	5.91 ^a	2.52 ^a	2.9 ^{ab}	0.85 ^a
180	T	2.72 ^{bc}	2.78 ^{abc}	6.2 ^a	6.02 ^a	2.66 ^a	2.64 ^{ab}	0.87 ^a
181	S	2.43 ^{cd}	2.5 ^{bcd}	6.24 ^a	6.29 ^a	2.69 ^a	2.33 ^b	0.85 ^a
182	S	2.75 ^{bc}	2.77 ^{abc}	5.89 ^a	6 ^a	2.72 ^a	2.68 ^{ab}	0.99 ^a
183	S	2.98 ^{ab}	3.04 ^a	6.71 ^a	6.3 ^a	2.71 ^a	2.87 ^{ab}	0.94 ^a
184	S	2.7 ^{bc}	2.84 ^{ab}	6.47 ^a	6.41 ^a	2.94 ^a	2.46 ^{ab}	0.81 ^a
185	S	3.17 ^a	3.15 ^a	6.47 ^a	6.28 ^a	2.75 ^a	2.55 ^{ab}	0.97 ^a
186	S	2.73 ^{bc}	2.78 ^{abc}	6.14 ^a	6.19 ^a	2.63 ^a	2.69 ^{ab}	0.77 ^a
187	SI	1.86 ^{ef}	1.87 ^f	5.38 ^a	5.39 ^a	2.41 ^a	2.53 ^{ab}	0.96 ^a
188	SI	1.84 ^f	1.86 ^f	5.18 ^a	5.56 ^a	2.67 ^a	2.85 ^{ab}	0.91 ^a
189	SI	1.56 ^f	1.57 ^f	5.42 ^a	5.28 ^a	2.71 ^a	3.39 ^a	0.91 ^a
<i>Mean</i>		<i>2.41</i>	<i>2.45</i>	<i>6.01</i>	<i>5.96</i>	<i>2.68</i>	<i>2.66</i>	<i>0.9</i>

Tab. S5 - Estimates of provenance values (adjusted means) for *Quercus robur*. Adjusted means having the same letter are not significantly different ($P < 0.05$). (*): Higher values mean earlier flushing.

Prov. ID	Cat.	Budburst6*	Budburst7*	Budburst8*	Height12 (m)	Diameter12 (cm)	Straightness13	Forks13	Survival13
260	T	2.66 ^{ab}	2.46 ^{abc}	2.74 ^{abc}	6.93 ^a	7.08 ^a	2.77 ^{abcde}	2.81 ^a	0.63 ^a
261	T	2.5 ^{abc}	2.29 ^{bcd}	2.72 ^{abc}	6.74 ^a	6.97 ^{ab}	3.21 ^a	3.18 ^a	0.79 ^a
262	T	2.97 ^a	2.88 ^a	3.22 ^a	6.53 ^a	6.6 ^{ab}	2.89 ^{abcd}	3.02 ^a	0.38 ^a
263	S	2.66 ^{ab}	2.49 ^{abc}	2.73 ^{abc}	7.69 ^a	7.36 ^a	3.1 ^{ab}	2.7 ^a	0.72 ^a
264	S	2.69 ^{ab}	2.7 ^{ab}	3.03 ^{ab}	7.11 ^a	7.47 ^a	3.05 ^{ab}	2.99 ^a	0.77 ^a
265	S	2.08 ^{cdef}	2.01 ^{cde}	2.1 ^{defg}	6.62 ^a	7.15 ^a	3.03 ^{abc}	3.12 ^a	0.63 ^a
266	SI	1.47 ^g	1.65 ^e	1.72 ^g	6.64 ^a	6.86 ^{ab}	2.36 ^{def}	2.75 ^a	0.58 ^a
267	SI	1.76 ^{fg}	1.65 ^e	1.8 ^{fg}	6.05 ^a	6.36 ^{ab}	2.82 ^{abcde}	3.15 ^a	0.6 ^a
268	SI	1.87 ^{efg}	1.89 ^{de}	2.13 ^{defg}	6.06 ^a	6.62 ^{ab}	2.69 ^{abcde}	2.91 ^a	0.64 ^a
269	SI	2 ^{cdef}	1.81 ^{de}	2.02 ^{efg}	5.91 ^a	6.52 ^{ab}	2.82 ^{abcde}	3.07 ^a	0.5 ^a
270	SI	1.66 ^{fg}	1.82 ^{de}	1.91 ^{fg}	7.2 ^a	6.71 ^{ab}	3.06 ^{ab}	2.98 ^a	0.45 ^a
271	SI	2.36 ^{bcde}	2.21 ^{cd}	2.61 ^{bcd}	6.19 ^a	6.65 ^{ab}	2.82 ^{abcde}	2.91 ^a	0.56 ^a
272	SI	2.06 ^{cdef}	1.81 ^{de}	2.28 ^{cdef}	6.04 ^a	6.5 ^{ab}	2.57 ^{bcde}	2.81 ^a	0.45 ^a
273	SI	1.95 ^{defg}	1.84 ^{de}	2.19 ^{cdefg}	6.21 ^a	6.27 ^{ab}	2.33 ^{ef}	3.76 ^a	0.49 ^a
274	SI	2.43 ^{bcd}	2.17 ^{cd}	2.54 ^{bcde}	6.5 ^a	6.28 ^{ab}	2.48 ^{cdef}	3.16 ^a	0.6 ^a
275	SI	1.82 ^{fg}	1.68 ^e	2.06 ^{efg}	4.38 ^a	5.03 ^b	2 ^f	2.8 ^a	0.33 ^a
Mean		2.18	2.09	2.36	6.42	6.65	2.75	3.01	0.57