

**Table S1.** Least squares means and ratios for growth traits by clone from the GLIMMIX. Standard errors (SE) are shown in brackets. Reference ratio for trees from the wild population (Białowieża) = 1. Tukey's honestly significant difference test,  $\alpha = 0.05$  was applied to test statistically significant differences between clones. The same lowercase letters accompanying LS-means indicate statistically homogenous groups of clones. Abbreviations: DBH: Diameter at breast height; H: Height; V: Stem volume; MAI: Mean annual increment; SE: Standard error; TA: *P. tremula*; TA × A: *P. tremula* × *P. alba*; TA × TE: *P. tremula* × *P. tremuloides*; TA: *P. tremula* a mixture of 30 clones of plus trees from wild populations in Białowieża (reference).

Clone	Taxon	DBH [cm]		H [m]		V [m <sup>3</sup> ha <sup>-1</sup> ]		MAI [m <sup>3</sup> ha <sup>-1</sup> yr <sup>-1</sup> ]	
		LS-mean	Ratio	LS-mean	Ratio	LS-mean	Ratio	LS-mean	Ratio
Wä 13.	TA × TE.	11.85 (0.16) a.	1.78 (0.03).	13.23 (0.11) a.	1.68 (0.02).	101.71 (2.98) a.	4.64 (0.34).	18.88 (0.56) a.	4.62 (0.25)..
Wä 14.	TA × TE.	10.68 (0.15) cd	1.6 (0.02).	12.89 (0.11) b.	1.64 (0.02).	81.32 (2.54) b.	3.71 (0.28).	15.11 (0.47) b.	3.7 (0.2)..
Ihl 174/9.	TA × TE.	10.7 (0.15) cb.	1.61 (0.02).	12.09 (0.1) c.	1.54 (0.01).	75.74 (2.42) c.	3.45 (0.26).	14.07 (0.44) c.	3.44 (0.19)..
CA-2-75.	TA × A.	10.93 (0.15) b.	1.64 (0.02).	10.53 (0.1) h.	1.34 (0.01).	71.96 (2.37) c.	3.28 (0.25).	13.38 (0.43) d.	3.28 (0.18)..
Ihl 174/10.	TA × TE.	10.47 (0.15) d.	1.57 (0.02).	11.22 (0.1) e.	1.43 (0.01).	67.82 (2.29) d.	3.09 (0.23).	12.6 (0.41) e.	3.08 (0.17)..
IBL 91/78.	TA × A.	10.77 (0.15) cb	1.62 (0.02).	10.32 (0.1) i.	1.31 (0.01).	66.37 (2.23) d.	3.03 (0.23).	12.33 (0.4) fe.	3.02 (0.17)..
164 A.	TA × TE.	9.87 (0.14) e.	1.48 (0.02).	12.21 (0.1) c.	1.55 (0.01).	64.65 (2.17) ed.	2.95 (0.22).	12 (0.39) f.	2.94 (0.16)..
W 3.	TA.	9.81 (0.14) e.	1.47 (0.02).	11.2 (0.1) fe.	1.42 (0.01).	61.09 (2.15) ef.	2.78 (0.21).	11.35 (0.38) g.	2.78 (0.16)..
Astria.	TA × TE.	9.41 (0.14) f.	1.41 (0.02).	11.56 (0.1) d.	1.47 (0.01).	57.57 (2.08) gf.	2.62 (0.2).	10.69 (0.36) h.	2.62 (0.15)..
IBL 55/8.	TA × A.	9.35 (0.14) f.	1.41 (0.02).	11.04 (0.1) fg.	1.4 (0.01).	53.7 (2.01) gh.	2.45 (0.19).	9.98 (0.34) i.	2.44 (0.14)..
Kh 73.	TA × TE.	9.33 (0.14) f.	1.4 (0.02).	10.27 (0.1) i.	1.31 (0.01).	52.7 (2.06) h.	2.4 (0.19).	9.8 (0.35) ji.	2.4 (0.14)..
Esch 8.	TA × TE.	8.94 (0.13) g.	1.34 (0.02).	11.29 (0.1) e.	1.43 (0.01).	51.56 (1.95) h.	2.35 (0.18).	9.58 (0.33) ji.	2.34 (0.13)..
Kh 83.	TA × TE.	8.99 (0.13) g.	1.35 (0.02).	11.17 (0.1) fe.	1.42 (0.01).	49.84 (1.95) ih.	2.27 (0.18).	9.26 (0.33) j.	2.27 (0.13)..
IBL 91/2.	TA × A.	8.82 (0.13) hg.	1.32 (0.02).	10.34 (0.1) i.	1.31 (0.01).	46.1 (1.92) ij.	2.1 (0.17).	8.56 (0.32) k.	2.1 (0.12)..
Se 3.	TA × TE.	8.58 (0.13) i.	1.29 (0.02).	10.9 (0.1) g.	1.39 (0.01).	45.76 (1.91) ij.	2.09 (0.17).	8.5 (0.31) k.	2.08 (0.12)..
Wä 1.	TA × TE.	8.34 (0.13) j.	1.25 (0.02).	10.52 (0.1) h.	1.34 (0.01).	44.61 (1.93) kj.	2.03 (0.16).	8.29 (0.31) k.	2.03 (0.12)..
Esch 5.	TA × TE.	8.64 (0.13) hi.	1.3 (0.02).	9.81 (0.09) j.	1.25 (0.01).	41.24 (1.8) kl.	1.88 (0.15).	7.66 (0.29) l.	1.88 (0.11)..
IBL 264/2/2.	TA × TE.	8.06 (0.13) k.	1.21 (0.02).	9.24 (0.09) k.	1.17 (0.01).	41.27 (1.74) kl.	1.88 (0.15).	7.65 (0.29) l.	1.87 (0.11)..
Se 1.	TA × TE.	7.94 (0.13) k.	1.19 (0.02).	10.26 (0.1) i.	1.3 (0.01).	37.18 (1.91) ml.	1.7 (0.14).	6.91 (0.29) m.	1.69 (0.1)..
Se 4.	TA × TE.	7.88 (0.12) k.	1.18 (0.02).	9.65 (0.09) j.	1.23 (0.01).	34.6 (1.68) m.	1.58 (0.13).	6.43 (0.27) m.	1.57 (0.1)..
Białowieża.	TA.	6.66 (0.12) l.	= 1.	7.87 (0.08) l.	= 1.	21.94 (1.68) n.	= 1.	4.08 (0.24) n.	= 1..

**Table S2.** Least squares means and ratios for growth traits by taxon from the GLIMMIX. Standard errors (SE) are shown in brackets. Reference ratio for TA = 1. Tukey's honestly significant difference test,  $\alpha = 0.05$  was applied to test statistically significant differences between taxa. The same lowercase letters accompanying LS-means indicate statistically homogenous groups of taxa. Abbreviations: DBH: Diameter at breast height; H: Height; V: Stem volume; MAI: Mean annual increment; TA: *P. tremula*; TA  $\times$  A: *P. tremula*  $\times$  *P. alba*; TA  $\times$  TE: *P. tremula*  $\times$  *P. tremuloides*.

Taxon.	DBH [cm].		H [m].		V [m <sup>3</sup> ha <sup>-1</sup> ].		MAI [m <sup>3</sup> ha <sup>-1</sup> yr <sup>-1</sup> ].	
	LS-mean	Ratio	LS-mean	Ratio	LS-mean	Ratio	LS-mean	Ratio
TA $\times$ A	9.97 (0.12) a	1.20 (0.01)	10.56 (0.08) b	1.10 (>0.01)	59.58 (1.76) a	1.42 (0.05)	11.07 (0.32) a	1.42 (0.04)
TA $\times$ TE	9.34 (0.11) b	1.13 (0.01)	11.11 (0.08) a	1.16 (>0.01)	56.95 (1.47) b	1.36 (0.05)	10.58 (0.29) b	1.35 (0.04)
TA	8.29 (0.12) c	1	9.57 (0.1) c	1	42.02 (1.78) c	1	7.80 (0.29) c	1

**Table S3.** Pearson's correlations coefficient between papermaking traits. Values statistically significant at the level  $\alpha = 0.05$  are shown in bold. The green tones indicate positive correlation and the red tones negative relationship.

	Cellulose [% d.w.]	Hemicellulose [% d.w.]	Lignin [% d.w.]	Extractives [% d.w.]	Minerals [% d.w.]	Kappa number	Mean arithmetic fibre length [ $\mu$ m]	Mean weighted fibre length [ $\mu$ m]	Mean fibre width [ $\mu$ m]	Coarseness [mg m <sup>-1</sup> ]	Fine content [% in length]	Apparent density [g cm <sup>-3</sup> ]	Breaking length [cm]	Strain [%]	Breaking energy / TEA [J]	Tear resistance [kN m]	WRV [%]	WRV [%] beaten	Tensile index
Hemicellulose [% d.w.]	<b>-0.82</b>																		
Lignin [% d.w.]	<b>-0.87</b>	<b>0.45</b>																	
Extractives [% d.w.]	<b>-0.73</b>	0.29	<b>0.86</b>																
Minerals [% d.w.]	0.08	<b>-0.42</b>	0.11	0.25															
Kappa number	<b>0.94</b>	<b>-0.86</b>	<b>-0.91</b>	<b>-0.95</b>	<b>-0.52</b>														
Mean arithmetic fibre length [ $\mu$ m]	<b>0.80</b>	<b>-0.61</b>	<b>-0.83</b>	<b>-0.49</b>	0.31	0.63													
Mean weighted fibre length [ $\mu$ m]	<b>0.97</b>	<b>-0.74</b>	<b>-0.94</b>	<b>-0.65</b>	<b>-0.10</b>	<b>0.91</b>	<b>0.90</b>												
Mean fibre width [ $\mu$ m]	<b>0.88</b>	<b>-0.7</b>	<b>-0.88</b>	<b>-0.51</b>	0.18	0.77	<b>0.98</b>	<b>0.95</b>											
Coarseness [mg m <sup>-1</sup> ]	<b>0.63</b>	<b>-0.51</b>	<b>-0.68</b>	<b>-0.35</b>	0.48	0.48	<b>0.93</b>	<b>0.77</b>	<b>0.90</b>										

Fine content [% in length]	-0.57	0.37	<b>0.69</b>	0.34	-0.47	-0.31	<b>-0.90</b>	<b>-0.71</b>	<b>-0.87</b>	<b>-0.88</b>									
Apparent density [g cm <sup>3</sup> ]	<b>-0.85</b>	<b>0.64</b>	<b>0.75</b>	<b>0.70</b>	0.37	<b>-0.95</b>	-0.44	<b>-0.75</b>	-0.56	-0.33	0.14								
Breaking length [m]	<b>-0.63</b>	<b>0.73</b>	0.36	0.20	-0.03	0.09	-0.31	-0.44	-0.38	-0.22	0.24	<b>0.53</b>							
Strain [%]	0.28	-0.03	-0.46	-0.27	-0.11	0.52	0.48	0.43	0.50	0.41	<b>-0.65</b>	-0.10	0.11						
Breaking energy / TEA [J]	0.14	-0.05	-0.26	-0.07	0.34	-0.04	0.44	0.21	0.40	0.56	<b>-0.68</b>	0.04	0.07	<b>0.72</b>					
Tear resistance [mN]	<b>0.59</b>	-0.26	<b>-0.72</b>	<b>-0.65</b>	-0.18	0.74	<b>0.71</b>	<b>0.72</b>	<b>0.70</b>	<b>0.67</b>	-0.57	<b>-0.52</b>	-0.03	0.37	0.42				
WRV [%] unbeaten	0.48	-0.45	-0.28	-0.23	<b>-0.9</b>	0.55	-0.12	0.30	0.05	-0.30	0.22	-0.63	-0.65	0.09	-0.35	0.03			
WRV [%] beaten	<b>0.88</b>	<b>-0.7</b>	<b>-0.75</b>	-0.55	-0.35	<b>0.93</b>	0.61	<b>0.83</b>	<b>0.70</b>	0.37	-0.41	<b>-0.68</b>	<b>-0.68</b>	0.06	-0.24	0.39	<b>0.78</b>		
Tensile index	<b>-0.63</b>	<b>0.73</b>	0.36	0.20	-0.03	0.09	-0.31	-0.44	-0.38	-0.22	0.24	<b>0.53</b>	<b>1.00</b>	0.11	0.07	-0.03	<b>-0.65</b>	<b>-0.68</b>	
Tear index	<b>0.59</b>	-0.26	<b>-0.72</b>	<b>-0.65</b>	-0.18	0.74	<b>0.71</b>	<b>0.72</b>	<b>0.70</b>	<b>0.67</b>	-0.57	<b>-0.52</b>	-0.03	0.37	0.42	<b>1.00</b>	0.03	0.39	-0.03