

## SUPPLEMENTARY MATERIAL

**Table S1.** Distribution of species and stocklots in the experimental plot. Each cell corresponds to a planting row of 150 m long with 50 seedlings. The layout of the blocks in the experimental plot is fit to 36 parallel rows of 150 m long each (i.e. the table does not reflect the layout on the terrain).

Block 1	Block 2	Block 3
JUPH-HU	PIPR-HU	JUPH-HU
JUPH-AL	PIPR-TM	JUPH-AL
ARUN-HU	QUFA-TM	ARUN-HU
ARUN-AL	QUFA-FA	ARUN-AL
QUFA-TM	PIHA-HU	QUFA-TM
QUFA-FA	PIHA-TM	QUFA-FA
QUIL-HU	JUPH-AL	QUIL-HU
QUIL-TM	JUPH-HU	QUIL-TM
PIPR-HU	ARUN-HU	PIHA-HU
PIPR-TM	ARUN-AL	PIHA-TM
PIHA-HU	QUIL-HU	PIPR-HU
PIHA-TM	QUIL-TM	PIPR-TM

**Table S2.** Summary of the principal component analysis showing the total variance explained in four components extracted.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.6	33.0	33.0	3.6	33.0	33.0	3.4	31.0	31.0
2	3.3	29.6	62.6	3.3	29.6	62.6	2.9	26.7	57.7
3	1.5	13.3	75.9	1.5	13.3	75.9	1.7	15.2	72.8
4	1.1	10.2	86.1	1.1	10.2	86.1	1.5	13.3	86.1

**Table S3.** Rotated Component Matrix indicating the correlations between initial variables and the rotated components. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 5 iterations.

Seedling attributes	Component			
	1	2	3	4
Height, cm	<b>0.93</b>	0.28	-0.03	0.09
Shoot/root, g/g	<b>0.87</b>	-0.23	0.11	-0.06
Shoot dry weight, g	<b>0.84</b>	0.39	0.17	0.11
Sturdiness (H/D), cm/mm	<b>0.84</b>	-0.24	-0.09	0.28
Dickson quality index	-0.12	<b>0.95</b>	-0.06	-0.06
Root dry weight, g	-0.06	<b>0.93</b>	-0.19	-0.10
Stem diameter, mm	0.42	<b>0.80</b>	-0.07	-0.19
Root growth potential-weight, g	-0.20	-0.14	<b>0.88</b>	0.18
Root growth potential-length, n°	0.31	-0.10	<b>0.88</b>	0.01
Foliar Nitrogen, %	0.23	0.06	0.14	<b>0.85</b>
Foliar Phosphorus, %	-0.01	-0.40	0.04	<b>0.74</b>

**Table S4.** Early growth (2008) rates for diameter (mm/month), height (cm/month) and volume (cm<sup>3</sup>/month); and survival (2008, 2009 and 2019) for both stocklots in each species. In the growth rates, suffix 1 relates to spring and 2 to summer. In a species, asterisks (or + sign) mean significant differences according to the t-test between both stocklots (+: p≤0.1, \*: p≤0.05, \*\*: p≤0.01, \*\*\*: p≤0.001).

Stocklot	Inc.D1	Inc.H1	Inc.Voll	Inc.D2	Inc.H2	Inc.Vol2	Surv08	Surv09	Surv18
ARUN_AL	.31±.15*	3.3±2.1	.32±.21***	.14±.11	.07±1.24 <sup>+</sup>	.14±.18***	.97±.01	.84±.08	.27±.03
ARUN_HU	.26±.15*	3.32±1.59	.11±.1***	.15±.11	.35±1.14 <sup>+</sup>	.07±.07***	.93±.05	.87±.10	.25±.19
JUPH_AL	.28±.13***	.55±.52 <sup>+</sup>	.06±.04 <sup>+</sup>	.14±.11	.29±.28	.05±.04 <sup>+</sup>	.97±.05	.95±.07	.78±.12 <sup>+</sup>
JUPH_HU	.22±.17***	.68±.48 <sup>+</sup>	.05±.05 <sup>+</sup>	.12±.13	.22±.29	.04±.05 <sup>+</sup>	.92±.06	.89±.10	.66±.01 <sup>+</sup>
PIHA_HU	.44±.2	1.49±.78***	.21±.14	.2±.16	.86±.57***	.18±.16*	.97±.02 <sup>+</sup>	.92±.02 <sup>+</sup>	.76±.11
PIHA_TM	.44±.18	.62±.63***	.19±.12	.17±.11	.58±.59***	.15±.12*	.93±.04 <sup>+</sup>	.86±.07 <sup>+</sup>	.71±.15
PIPR_HU	.44±.19*	.96±.63	.23±.17	.17±.13	.35±.51	.14±.15	.88±.06	.50±.06	.12±.09
PIPR_TM	.48±.14*	.85±.67	.21±.09	.16±.13	.39±.4	.13±.11	.87±.11	.53±.25	.09±.06
QUFA_FA	.21±.18***	2.82±1.83	.18±.15***	.18±.15***	.05±.94***	.11±.17	.72±.18	.35±.24	0.0±.0*
QUFA_TM	.34±.19***	2.42±2.5	.52±.4***	.12±.13**	-.8±2.53***	.08±.4	.74±.08	.27±.21	.04±.04*
QUIL_HU	.29±.17*	2.29±1.25***	.18±.11***	.14±.18	.32±.89	.11±.15	.73±.11**	.54±.17	.13±.08
QUIL_TM	.25±.2*	3.14±1.54***	.37±.25***	.12±.16	.14±1.31	.14±.23	.86±.05**	.61±.08	.16±.07

**Table S5.** Summary of the Boosted Regression Trees (BTR) models fitted for survival in the first (2008), second (2009) and tenth (2018) year after out-planting. In BRT, the measure of model fit is the total % deviance explained and model predictive performance (the mean CV correlation coefficient of observed vs predicted values derived from 10 folds). Cross-validation correlation coefficients were used to weight the relative importance of the predictors. se: standard error of the coefficients. ROC: area under the ROC curve (0.5-1).

Species	Survival	Nº. trees	Mean total deviance	Mean residual deviance	Estimated cross-validation deviance (se)	Training data ROC score	Cross-validation ROC score (se)
ARUN	2008	1600	0.39	0.271	0.372(0.027)	0.94	0.72(0.055)
	2009	2750	0.833	0.488	0.764(0.036)	0.99	0.75(0.025)
	2018	4950	1.155	1.01	1.052(0.031)	0.71	0.69(0.037)
JUPH	2008	250	0.454	0.434	0.452(0.033)	0.88	0.59(0.084)
	2009	1750	0.582	0.565	0.577(0.033)	0.88	0.61(0.056)
	2018	2500	1.195	0.946	0.986(0.076)	0.73	0.73(0.049)
PIHA	2008	6900	0.335	0.243	0.314(0.02)	0.95	0.72(0.08)
	2009	1700	0.626	0.299	0.504(0.034)	0.99	0.75(0.049)
	2018	4750	1.183	0.822	0.868(0.029)	0.80	0.79(0.017)
PIPR	2008	1100	0.752	0.631	0.738(0.021)	0.94	0.63(0.031)
	2009	2600	1.385	0.863	1.26(0.044)	0.99	0.65(0.038)
	2018	4500	0.679	0.468	0.512(0.024)	0.88	0.87(0.011)
QUFA	2008	1400	1.167	0.808	1.06(0.039)	0.93	0.72(0.038)
	2009	350	1.239	0.661	1.004(0.046)	0.96	0.80(0.027)
	2018						
QUIL	2008	1450	1.016	0.802	0.977(0.022)	0.93	0.65(0.047)
	2009	4300	1.366	0.68	1.058(0.047)	0.97	0.79(0.022)
	2018	300	0.824	0.519	0.746(0.039)	0.97	0.75(0.032)

**Table S6.** Relative importance (RI, %, obtained from BRT models) on plantation survival ( 2008, 2009 and 2018) of the different sets of traits or independent variables: site (experimental block, BQ), plant traits (shoot, root and early growth performance) and stock quality traits (shoot, root, RGP and nutrients). RI was weighted by the cv ROC score. Partial dependence plots of the 4 highest-ranked predictors are presented in Figure 6 and SM2.

Species	Survival year	Site BQ	Indiv. plant traits			Stock quality ass. traits				Total RI
			Shoot	Root	Perfm	Shoot	Root	Perfm	Nutr	
ARUN	2008	0.3	15.0	22.0	37.8	0.0	0.0			75.0
	2009	0.5	12.2	2.2	60.1	0.0	0.0			75.0
	2018	2.6	18.6	8.2	38.9	0.7	0.0			69.0
JUPH	2008	0.1	9.3	14.5	34.7					58.6
	2009	0.2	13.1	11.7	36.2	0.0	0.0			61.2
	2018	1.3	32.9	16.5	20.3	0.6	0.9			72.5
PIHA	2008	0.3	28.0	2.3	41.5	0.0	0.0			72.0
	2009	1.1	13.9	3.1	56.6					74.7
	2018	1.7	27.8	3.1	46.2	0.2	0.2			79.2
PIPR	2008	3.5	24.7	9.2	25.2	0.0	0.0			62.6
	2009	1.7	20.8	7.5	34.9	0.0	0.0			64.9
	2018	1.5	15.0	7.0	61.6	0.8	0.8			86.8
QUFA	2008	1.5	23.4	6.8	40.1	0.1			0.1	71.9
	2009	11.8	13.4	6.8	47.3	0.1			0.2	79.6
	2018									
QUIL	2008	1.4	23.9	7.7	32.2					65.1
	2009	3.9	18.5	6.3	50.7	0.0				79.4
	2018	1.6	39.0	13.6	21.2	0.0				75.3

**Table S7.** Summary of the Boosted Regression Trees (BTR) models fitted for traits of early growth performance: monthly increment in diameter (Inc.D), height (Inc.H) and stem volume (Inc.Vol) either in the spring after planting (1) or in the first summer (2). Cross-validation correlation coefficients were used to weight the relative importance of the predictors except Inc. H1 in ARUN where training data correlation was used. se: standard error of the coefficients. In PIPR, the monthly relative growth rate (RGR) for height growth in summer was used instead the net monthly increment as no model could be fitted in the latter.

Species	Early growth Variable	No. of trees	Mean total deviance	Mean residual deviance	Estimated cross-Validation deviance (se)	Training data correlation	Cross-Validation correlation (se)
ARUN	Inc.D1	2050	0.022	0.01	0.02(0.00)	0.82	0.53(0.04)
	Inc.D2	1000	0.012	0.01	0.01(0.00)	0.56	0.00(0.05)
	Inc.H1	500	3.549	3.08	3.60(0.37)	0.62	0.12(0.06)
	Inc.H2	1200	1.417	1.37	1.42(0.80)	0.48	0.09(0.08)
	Inc.Vol1	2500	0.039	0.01	0.02(0.00)	0.85	0.68(0.05)
	Inc.Vol2	3900	0.022	0.02	0.02(0.01)	0.68	0.17(0.07)
JUPH	Inc.D1	4850	0.024	0.011	0.016(0.002)	0.77	0.58(0.04)
	Inc.D2	2050	0.014	0.008	0.013(0.003)	0.76	0.32(0.09)
	Inc.H1	3300	0.252	0.141	0.209(0.032)	0.72	0.45(0.06)
	Inc.H2	450	0.081	0.037	0.069(0.009)	0.80	0.42(0.03)
	Inc.Vol1	1750	0.002	0.001	0.001(0.000)	0.78	0.57(0.04)

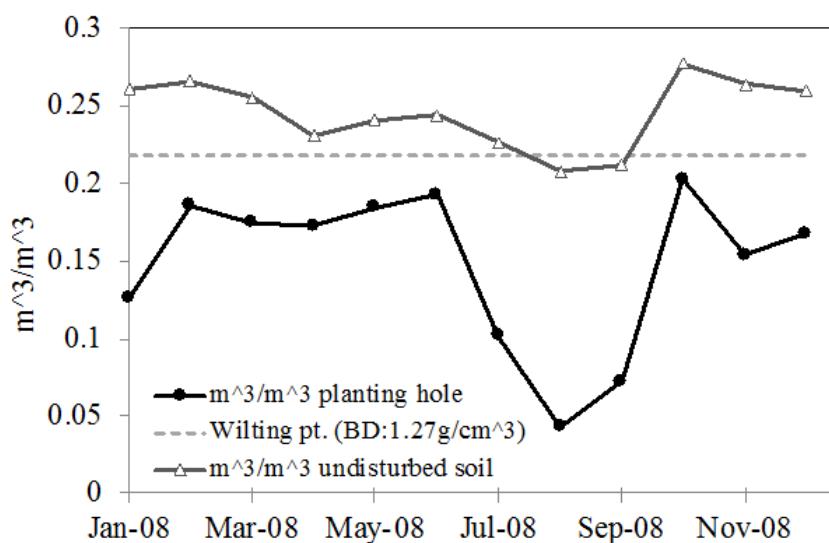
	Inc.Vol2	1950	0.002	0.002	0.002(0.001)	0.70	0.36(0.07)
PIHA	Inc.D1	1700	0.031	0.014	0.023(0.002)	0.80	0.54(0.04)
	Inc.D2	1000	0.018	0.018	0.018(0.002)	0.67	0.08(0.06)
	Inc.H1	1450	0.704	0.321	0.553(0.068)	0.81	0.47(0.03)
	Inc.H2	5050	0.334	0.282	0.327(0.049)	0.61	0.17(0.04)
	Inc.Vol1	3450	0.017	0.008	0.012(0.001)	0.78	0.53(0.03)
	Inc.Vol2	1400	0.019	0.012	0.017(0.002)	0.72	0.29(0.06)
PIPR	Inc.D1	1750	0.029	0.013	0.021(0.002)	0.80	0.53(0.05)
	Inc.D2	1200	0.017	0.013	0.016(0.002)	0.66	0.21(0.06)
	Inc.H1	1350	0.423	0.230	0.361(0.052)	0.77	0.40(0.05)
	RGR.H2	1000	0.001	0.001	0.001(0.000)	0.50	0.04(0.05)
	Inc.Vol1	2000	0.019	0.006	0.011(0.001)	0.84	0.59(0.06)
	Inc.Vol2	1700	0.017	0.013	0.016(0.003)	0.69	0.23(0.08)
QUFA	Inc.D1	1150	0.022	0.014	0.02(0.005)	0.73	0.30(0.05)
	Inc.D2	1900	4.816	4.446	4.827(0.735)	0.66	0.10(0.07)
	Inc.H1	4600	3.833	3.292	3.796(1.154)	0.61	0.18(0.07)
	Inc.H2	1400	0.12	0.060	0.091(0.024)	0.77	0.53(0.05)
	Inc.Vol1	1000	0.095	0.095	0.097(0.032)	0.64	0.02(0.06)
	Inc.Vol2	1150	0.022	0.014	0.02(0.005)	0.73	0.30(0.05)
QUIL	Inc.D1	2600	0.034	0.025	0.033(0.005)	0.72	0.18(0.04)
	Inc.D2	2350	0.029	0.019	0.027(0.003)	0.73	0.27(0.05)
	Inc.H1	3600	2.142	1.231	1.865(0.154)	0.76	0.38(0.06)
	Inc.H2	2000	1.298	1.038	1.279(0.390)	0.67	0.13(0.09)
	Inc.Vol1	3450	0.046	0.017	0.028(0.004)	0.82	0.64(0.05)
	Inc.Vol2	4100	0.039	0.022	0.037(0.007)	0.77	0.27(0.07)

**Table S8.** Relative importance (RI, %, obtained from BRT models) of the different sets of traits and independent variables: site (experimental block, BQ), plant traits (shoot and root) and stock quality attributes (shoot, root, RGP and nutrients) on plantation early-growth performance (increment in diameter, D; height, H; and volume, Vol; in the first growing season, 1; and in the first summer, 2). RI was weighted by the cv correlation. In PIPR, the monthly relative growth rate (RGR) for height growth in summer was used instead the net monthly increment as no model could be fitted in the latter. Partial dependence plots of the 4 highest-ranked predictors are presented in Figure 7 and SM3.

Species	Survival year	Site	Indiv. plant traits		Stock quality ass. traits			Total RI
			BQ	Shoot	Root	Shoot	Root	
ARUN	Inc D1	18.0	28.5	6.5	0.0	0.0		53.0
	Inc D2	0.0	0.0	0.0	0.0	0.0		0.0
	Inc H1	0.7	7.8	3.5	0.0			12.0
	Inc H2	0.1	7.0	1.8	0.0	0.0		9.0
	Inc Vol1	7.9	53.9	6.2	0.0			68.0
	Inc Vol2	0.6	14.5	1.8	0.1			17.0
JUPH	IncD1	1.9	43.1	12.4	0.4	0.4		58.2
	IncD2	3.3	16.9	12.2		0.0		32.4
	IncH1	9.6	20.4	14.5	0.0	0.0		44.6
	IncH2	5.0	28.7	8.5	0.0	0.0		42.2
	IncVol1	4.0	43.2	9.9	0.1	0.0		57.2
	IncVol2	2.8	24.7	8.8	0.0			36.4
PIHA	IncD1	11.6	33.4	9.1	0.0	0.0		54.1

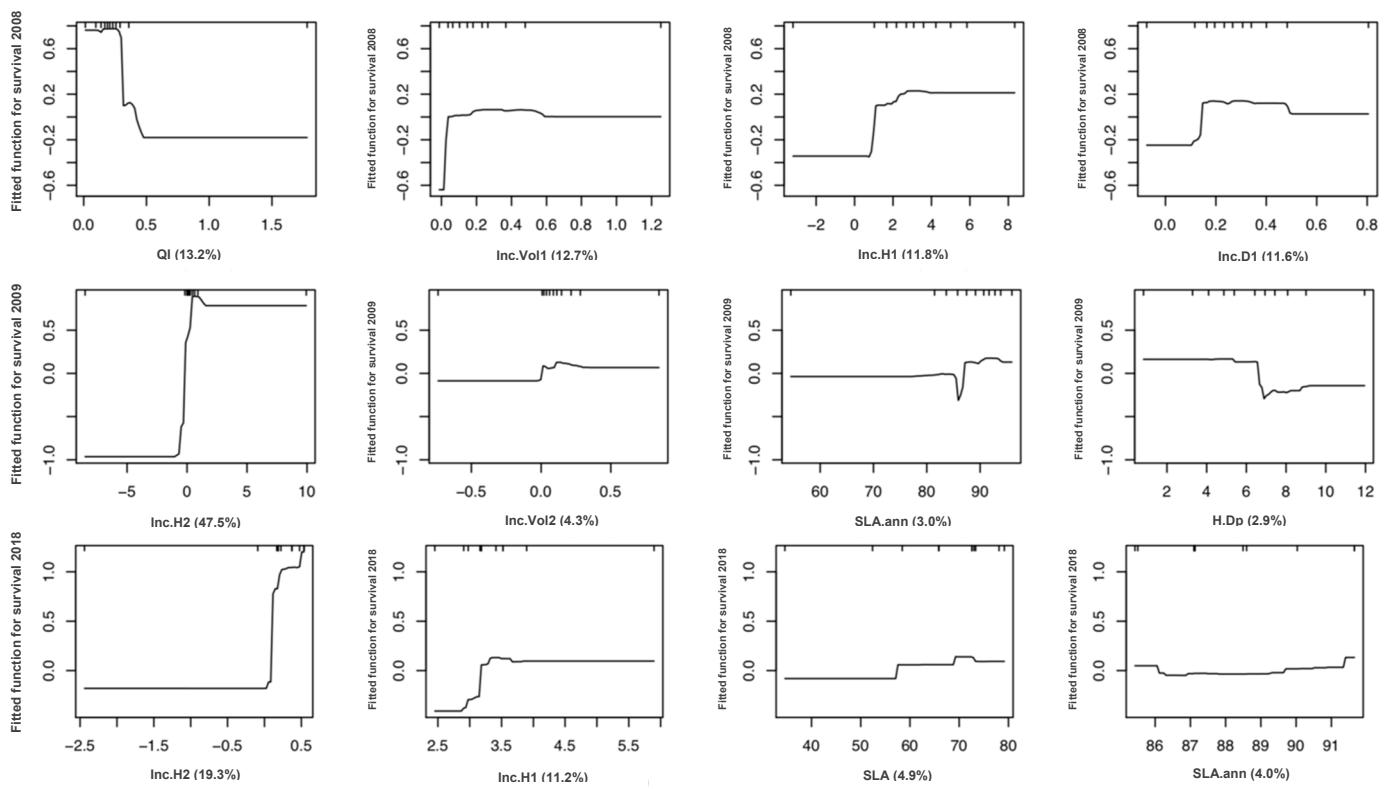
	IncD2	0.9	5.3	2.0	0.0				8.2
	IncH1	4.2	35.3	6.0	0.7	0.8			47.0
	IncH2	0.8	13.0	3.3	0.0				17.2
	IncVol1	7.3	40.9	4.9	0.0				53.1
	IncVol2	4.8	16.4	8.1					29.3
PIPR	Inc D1	7.7	35.4	9.8	0.0	0.0			52.9
	Inc D2	3.2	11.2	6.2	0.0	0.0			20.6
	Inc H1	10.6	22.1	7.7	0.0	0.0			40.5
	Inc Vol1	3.4	48.2	7.6	0.0	0.0			59.2
	Inc Vol2	3.3	15.7	4.4	0.0	0.0			23.4
	RGR H2	0.1	2.8	0.9	0.0	0.0			3.8
QUFA	Inc D1	3.1	22.7	4.1	0.6			0.4	30.9
	Inc D2	1.3	22.2	6.3	0.0			0.0	29.8
	Inc H1	0.6	7.3	2.0	0.1			0.0	10.0
	Inc H2	2.8	10.4	4.9	0.0			0.0	18.1
	Inc Vol1	3.6	38.1	10.6	0.4			0.4	53.2
	Inc Vol2	0.2	1.7	0.5	0.0	0.0		0.0	2.4
QUIL	IncD1	1.0	13.7	2.9					17.6
	IncD2	5.7	14.6	6.9	0.0				27.3
	IncH1	1.7	30.2	6.2	0.0				38.1
	IncH2	0.4	9.7	2.3	0.0				12.5
	IncVol1	1.2	48.0	15.2					64.4
	IncVol2	2.2	15.0	9.8	0.0				27.0

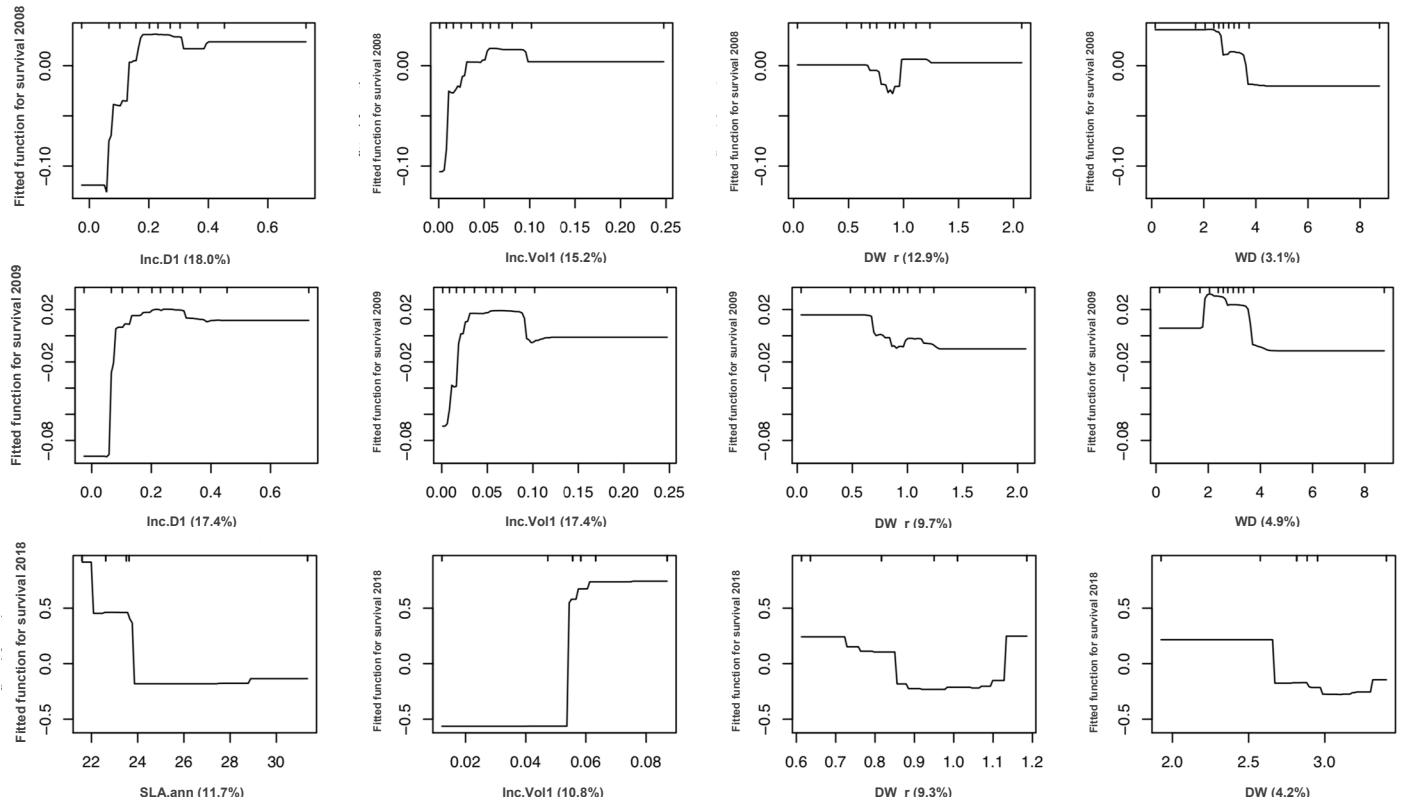
**Figure S1.** Volumetric soil water content during the first year of plantation 2008 at two different points: undisturbed soil and stirred soil in the planting spot. Soil moisture content at the permanent wilting point was computed by introducing sand and clay contents in Saxton's Equations, which provided a bulk density of  $1.27 \text{ g/cm}^3$  (<https://hrsl.ba.ars.usda.gov/soilwater/Index.htm>).



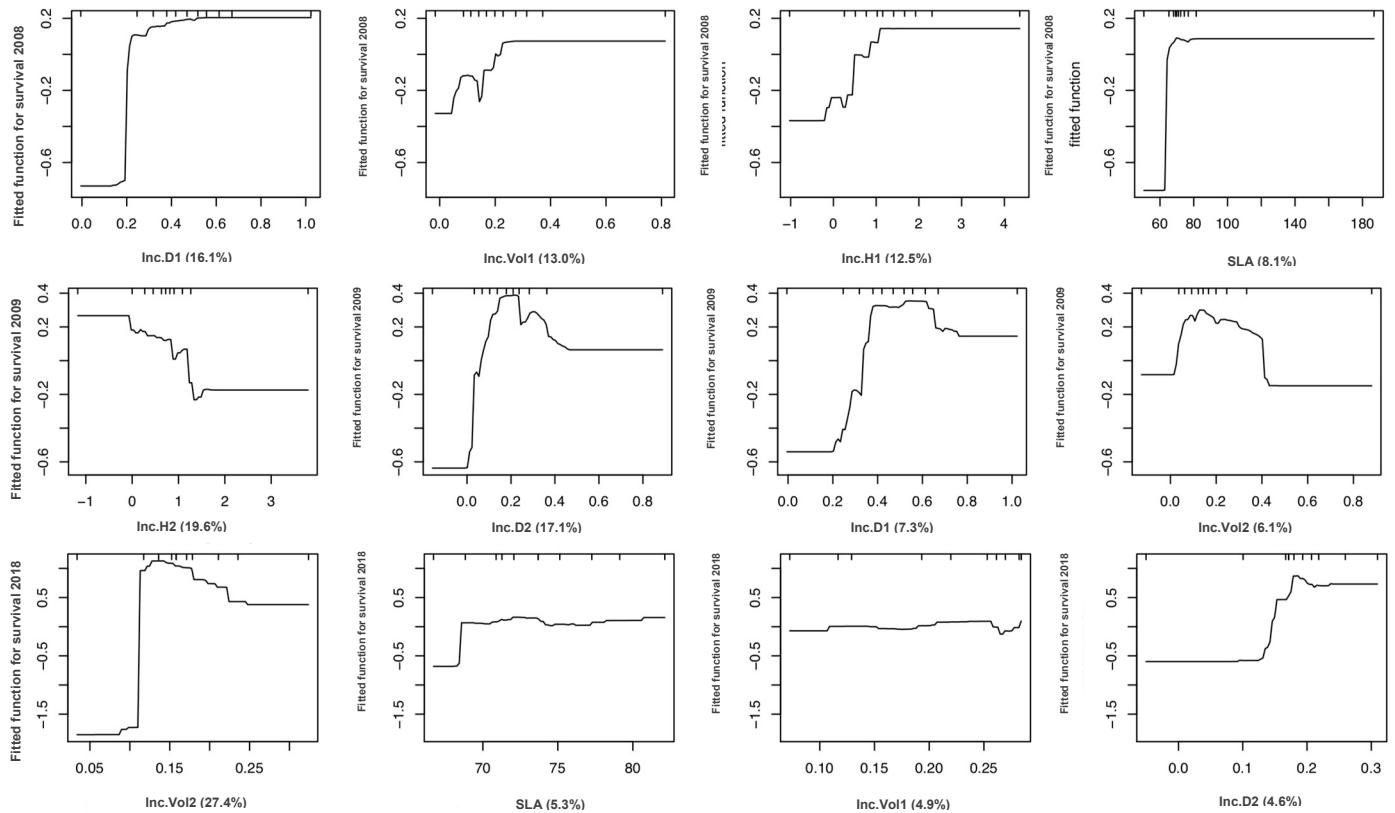
**Figure S2.** Partial dependence plots (PDP) of the four most influential variables or predictors (higher relative importance in the BRT models) on plantation survival performance (2008, 2009 and 2018). *Y* axis centered to have zero mean over the data distribution

# ARUN

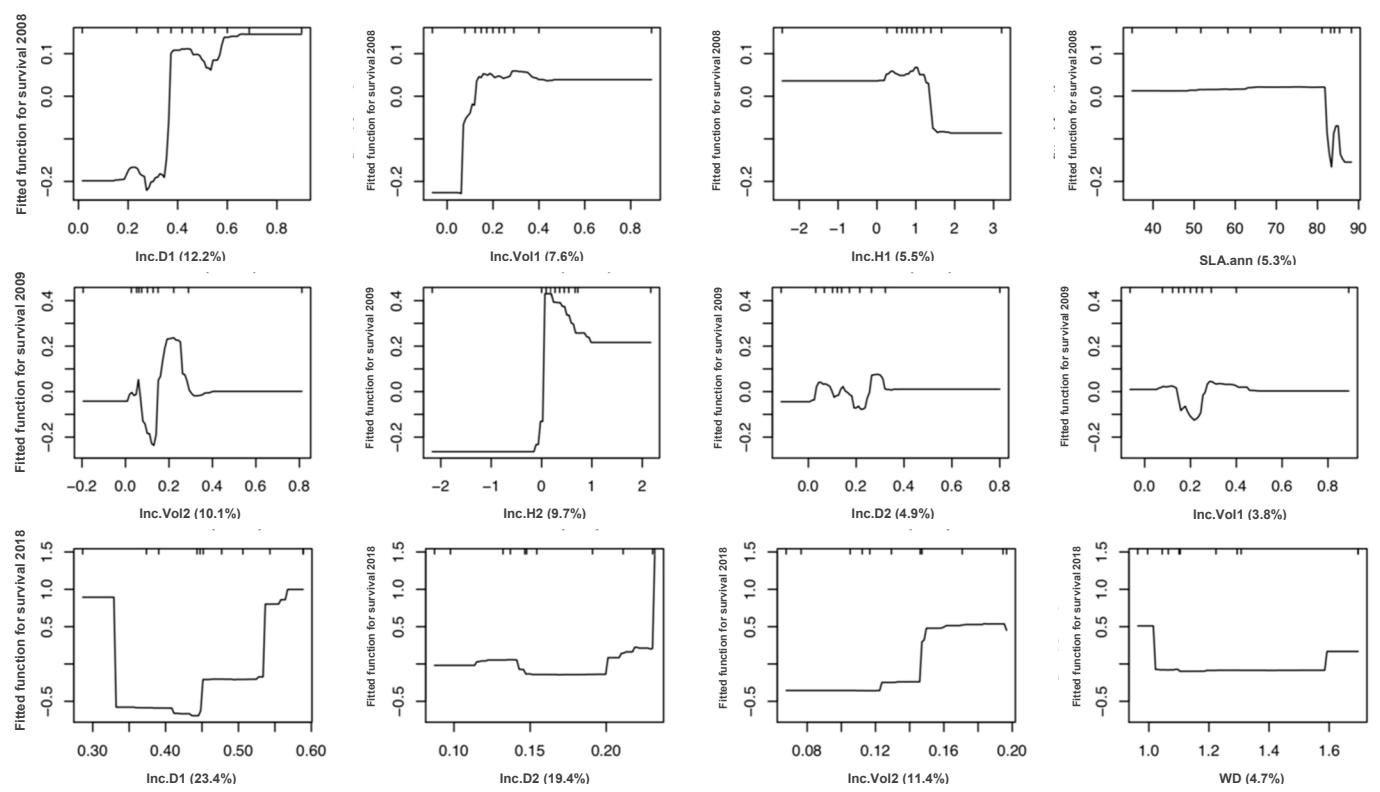


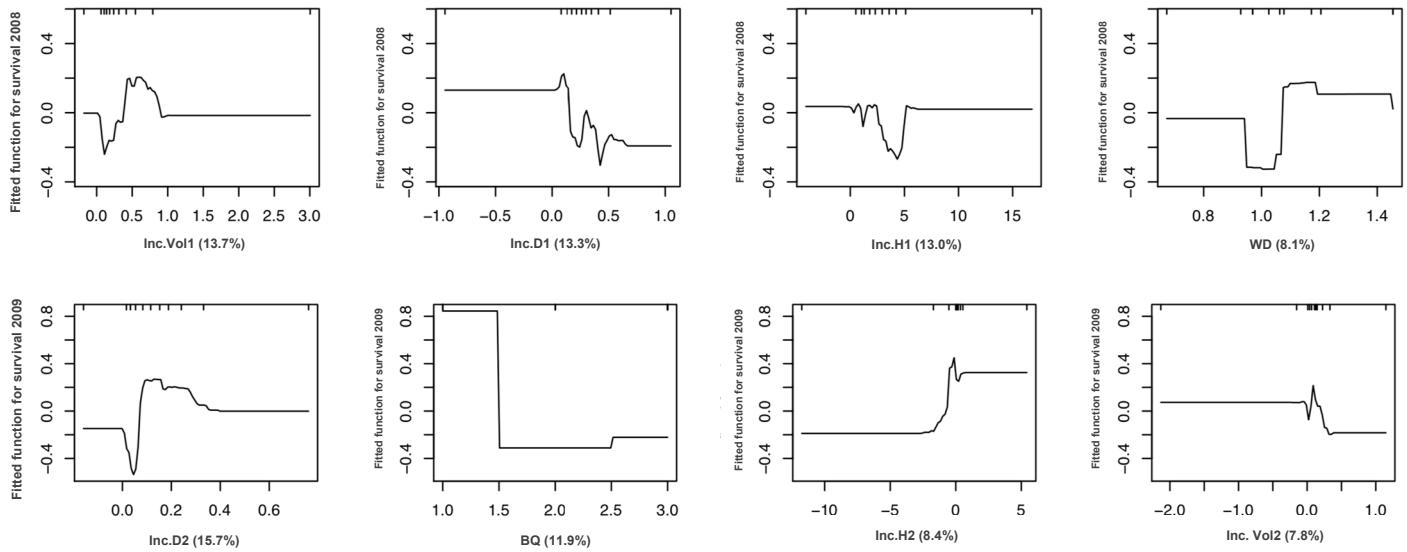


# PIHA



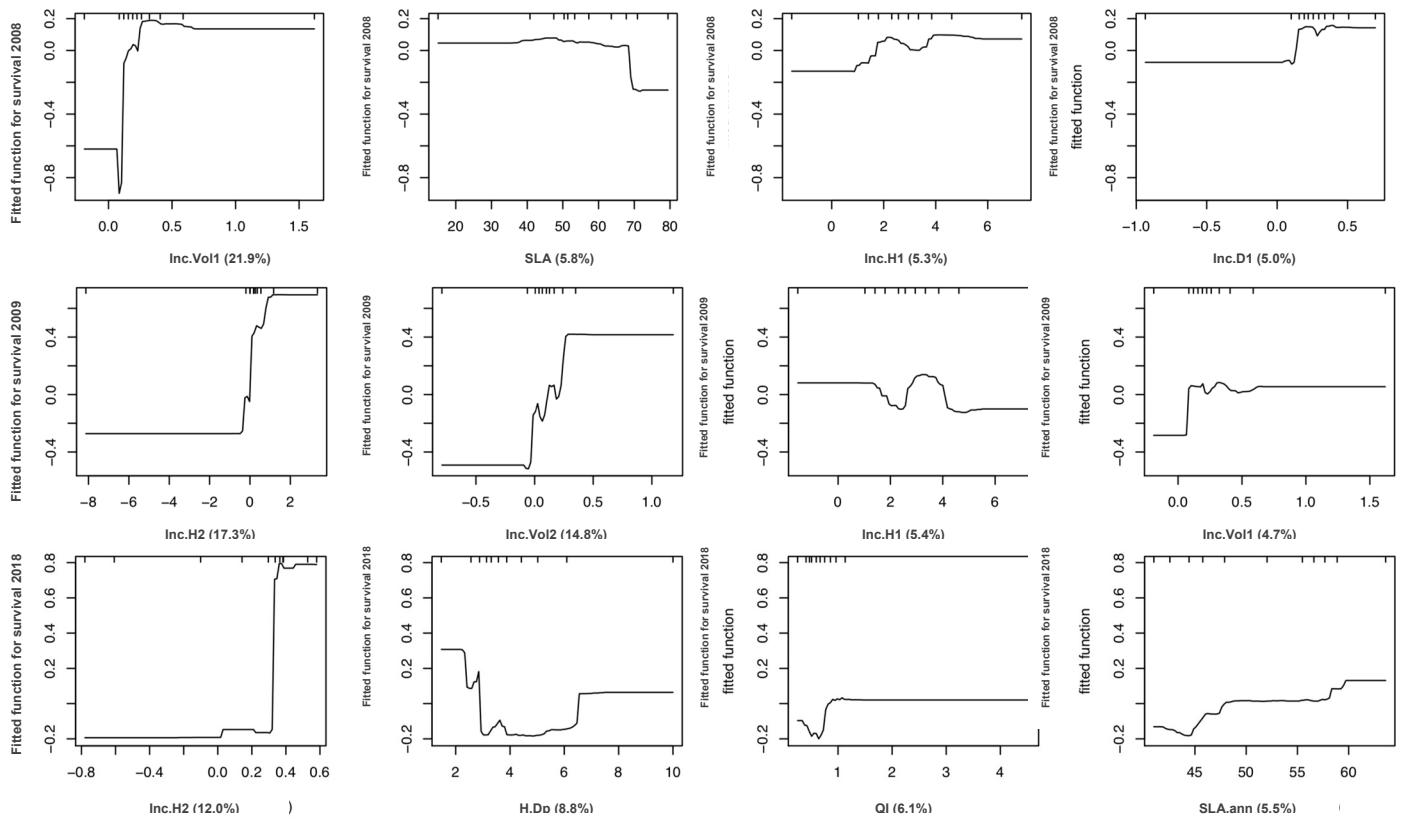
# PIPR



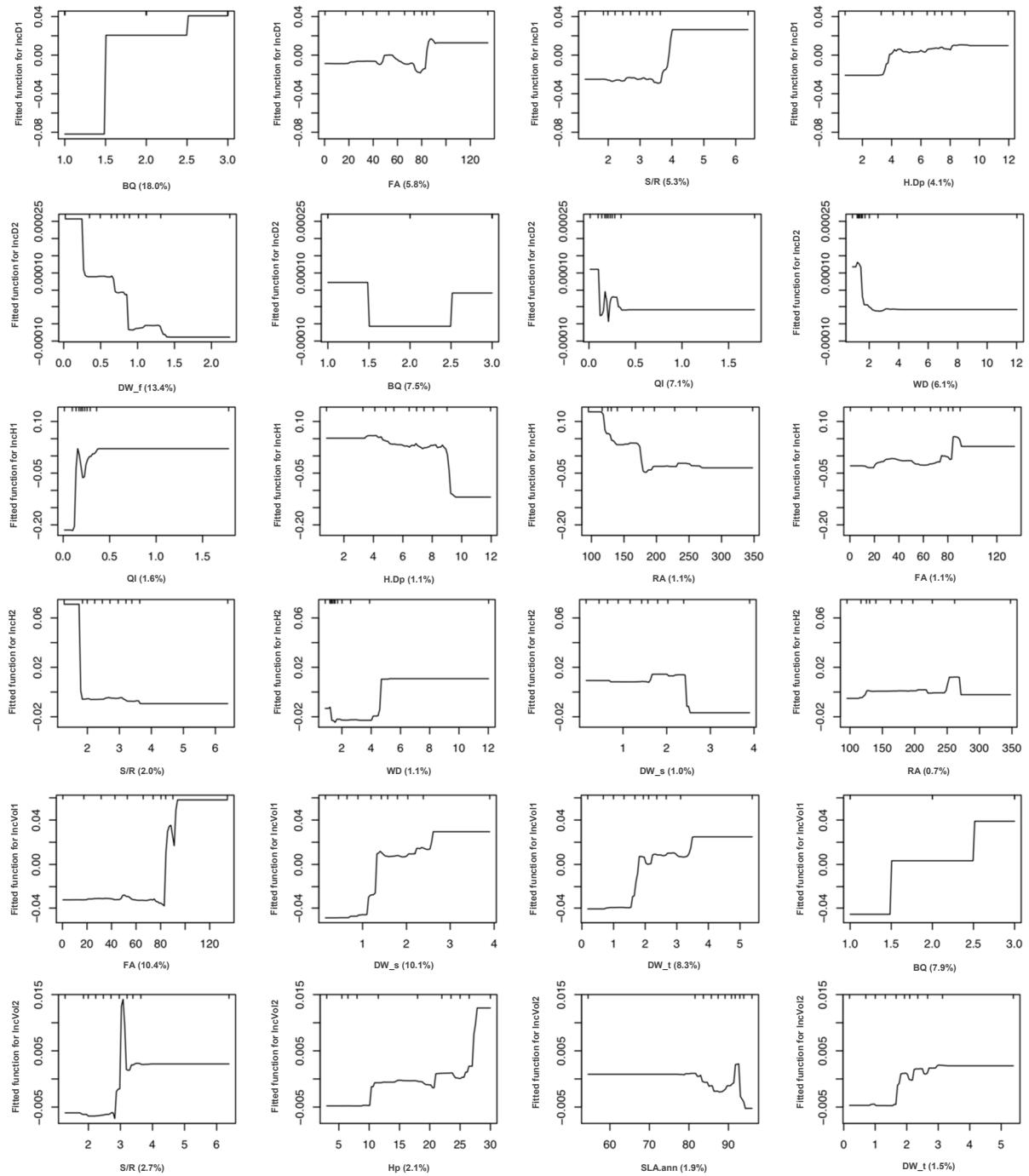


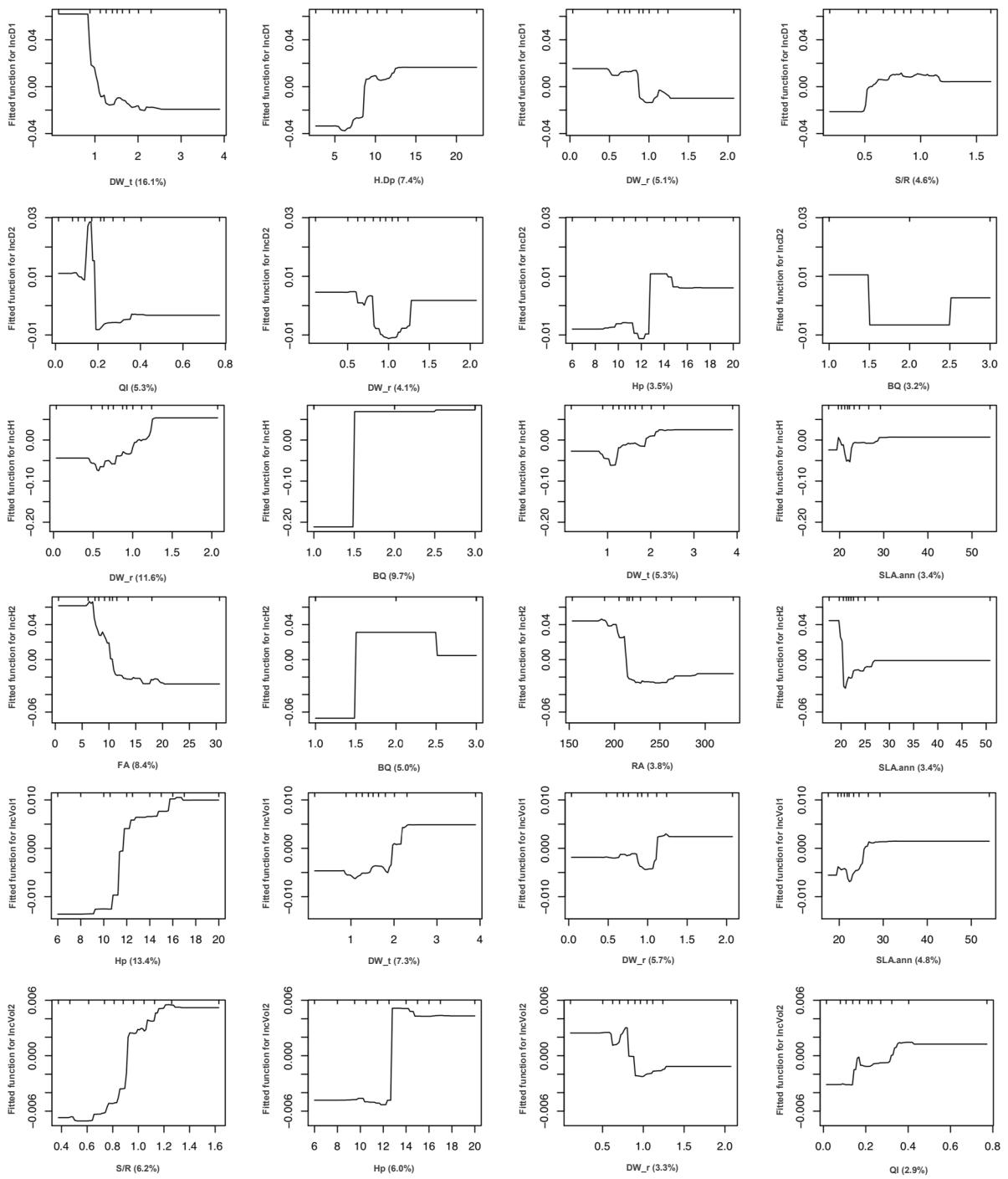
Surv 2018 QUFA: not available

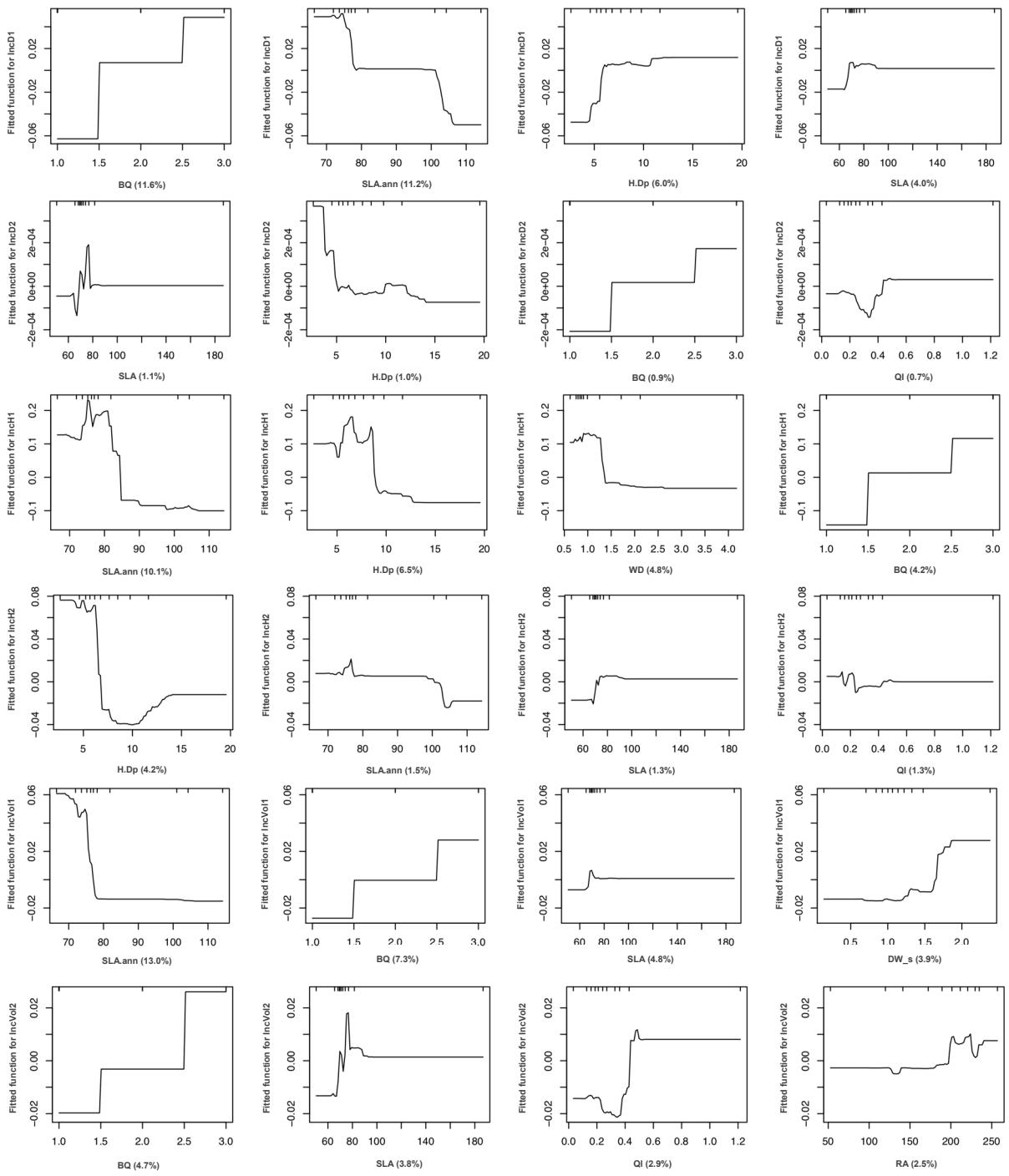
# QUIL



**Figure S3.** Partial dependence plots (PDP) of the four most influential variables or predictors (higher relative importance in the BRT models) on early growth performance: diameter growth (IncD), height growth (IncH) and volume increment (IncVol), all of them computed for the first spring and first summer after planting (suffixes 1 and 2 respectively) and at monthly interval. *Y* axis centered to have zero mean over the data distribution.







# PIPR

