

**Implementation of different relationship estimate methodologies in Breeding Value prediction in kiwiberry
(*Actinidia arguta*)**

Molecular Breeding

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Supplementary Table 1 *Actinidia arguta* kiwiberry population structure considering a two factorial crossing scheme with distant ancestral relatives (grey), female parents (red) and male parents (blue). **a** 13 female and **(b)** male parents are originated from the same cross, indicated by same distant ancestors.

a				b			
Distant Ancestors		Female Parent	Male Parent		Male Parent	AA02_01	AA01_01
Mother	Father		AA05_06	AA13_01		AA13_01	AA04_01
						Mother	Distant
						Father	Ancestors
						Female Parent	
						'Hortgem Tahi'	'Hortgem Toru'
AA06_01	AA04_02	N01.165-12-05	x	x	N01.161-17-04	x	x
AA06_01	AA07_03	N01.166-14-04	x	x	N01.161-04-05	x	x
AA06_01	AA13_01	N01.166-02-03	x	x	N01.162-01-03	x	x
AA06_01	AA13_01	N01.167-13-01	x	x	N01.162-22-01	x	x
AA06_01	AA13_01	N01.168-09-05	x	x	N01.164-06-04	x	
AA05_03	AA04_01	N01.166-05-04	x	x	N01.168-24-01	x	x
AA05_03	AA05_06	N01.163-01-01	x	x	N01.161-16-03	x	x
AA05_03	AA05_07	N01.161-09-02	x	x	N01.165-20-03	x	
AA05_03	AA07_01	N01.167-25-01	x	x	N01.162-02-04	x	x
AA06_01	AA04_01	N01.165-11-01	x	x	-		
AA06_01	AA04_01	N01.167-11-04	x	x	-		
AA06_01	AA05_07	N01.165-09-01	x	x	-		
AA05_03	AA05_06	N01.163-01-02	x	x	-		
-	-	AA09_01	x	x	-		
AA06_01	AA07_01	-			N01.161-02-04	x	x
AA05_03	AA04_02	-			N01.162-19-05	x	x
AA05_03	AA04_02	-			N01.166-02-05	x	
AA05_03	AA07_03	-			N01.164-09-04	x	

Supplementary Table 2 Showing absolute range of scored *Actinidia arguta* kiwiberry fruit load.

Score	No. of fruit
0	0
0.5	1–4
1	5–10
2	11–30
3	31–60
4	61–100
5	101–200
6	201–300
7	301–400
8	401–500
9	501+

Supplementary Table 3 Estimation of *Actinidia arguta* kiwiberry genetic parameters and expected genetic gain (EGG) for one vine trait and five fruit traits analysed with a linear mixed model (LMM), considering different relationship matrices, indicated by the letter (A and G), ploidy (2 and 4), and significance differences by the letters from Tukey's HSD test. A double reduction coefficient (w) of 10% was incorporated into a second A4 model. A full model, considering all female vines with observations, was included to predict variance components and heritability. The 10-fold cross-validation model was replicated 10 times and each time a new random 10-fold grouping was analysed.

Trait	Relationship matrix	Full – model					10-fold cross-validation (10x)					
		σ_a^2	σ_e^2	h_{NS}^2 (SE)	$\bar{\sigma}_a^2$	$\bar{\sigma}_e^2$	$\overline{h_{NS}^2}$	EGG 2017	EGG 2018	EGG 2019	EGG 2020	EGG overall
Fruit Load	A2	2.08	1.75	0.54 (0.05)	2.08 ^a	1.75 ^b	0.54 ^a	0.39 ^a	0.40 ^a	-	-	0.44 ^a
	A4	2.06	1.75	0.54 (0.05)	2.06 ^a	1.75 ^b	0.54 ^a	0.39 ^a	0.40 ^a	-	-	0.44 ^a
	A4 ^ω	1.79	1.75	0.51 (0.05)	1.79 ^c	1.75 ^b	0.51 ^c	0.37 ^b	0.37 ^b	-	-	0.41 ^b
	G2	1.88	1.68	0.53 (0.05)	1.91 ^b	1.68 ^c	0.53 ^b	0.38 ^{ab}	0.37 ^b	-	-	0.41 ^b
	G4	1.31	2.10	0.38 (0.06)	1.36 ^d	2.07 ^a	0.40 ^d	0.31 ^c	0.29 ^c	-	-	0.33 ^c
Fruit Weight (g)	A2	4.71	1.50	0.76 (0.02)	4.71 ^b	1.50 ^b	0.76 ^a	0.58 ^a	0.52 ^a	0.50 ^a	-	0.57 ^a
	A4	4.67	1.50	0.76 (0.02)	4.67 ^b	1.50 ^b	0.76 ^a	0.58 ^a	0.52 ^a	0.48 ^a	-	0.57 ^a
	A4 ^ω	4.06	1.50	0.73 (0.03)	4.06 ^c	1.50 ^b	0.73 ^c	0.54 ^{ab}	0.48 ^{ab}	0.45 ^a	-	0.53 ^b
	G2	3.63	1.49	0.71 (0.03)	3.66 ^d	1.49 ^c	0.71 ^d	0.49 ^c	0.44 ^c	0.44 ^a	-	0.49 ^c
	G4	4.92	1.62	0.75 (0.03)	4.80 ^a	1.61 ^a	0.75 ^b	0.53 ^{bc}	0.47 ^{bc}	0.45 ^a	-	0.53 ^b
Dry Matter (%)	A2	4.21	2.93	0.59 (0.05)	4.21 ^a	2.96 ^b	0.59 ^a	0.40 ^a	0.33 ^a	0.41 ^a	-	0.37 ^a
	A4	4.17	2.93	0.59 (0.05)	4.18 ^a	2.96 ^b	0.59 ^a	0.40 ^a	0.33 ^a	0.41 ^a	-	0.37 ^a
	A4 ^ω	3.62	2.93	0.55 (0.05)	3.63 ^b	2.96 ^b	0.55 ^b	0.37 ^{ab}	0.31 ^{ab}	0.38 ^{ab}	-	0.35 ^{ab}

	G2	3.32	2.89	0.53 (0.05)	3.34 ^c	2.91 ^c	0.53 ^c	0.35 ^{bc}	0.30 ^b	0.37 ^b	-	0.32 ^b
	G4	3.19	3.26	0.50 (0.06)	3.22 ^d	3.26 ^a	0.50 ^d	0.35 ^c	0.29 ^b	0.32 ^c	-	0.32 ^b
Ripe Soluble Solids Content (Brix)	A2	3.34	2.43	0.58 (0.06)	3.33 ^a	2.43 ^b	0.58 ^a	0.35 ^a	0.31 ^a	-	-	0.32 ^a
	A4	3.31	2.43	0.58 (0.06)	3.30 ^a	2.43 ^b	0.58 ^a	0.35 ^a	0.31 ^a	-	-	0.32 ^a
	A4 ^ω	2.88	2.43	0.54 (0.06)	2.87 ^b	2.43 ^b	0.54 ^b	0.32 ^a	0.29 ^a	-	-	0.30 ^a
	G2	2.60	2.35	0.53 (0.06)	2.62 ^c	2.35 ^c	0.53 ^c	0.32 ^a	0.28 ^a	-	-	0.29 ^a
	G4	1.91	2.91	0.40 (0.07)	1.97 ^d	2.87 ^a	0.41 ^d	0.26 ^b	0.24 ^b	-	-	0.25 ^b
Fruit Circularity – crosswise	A2	6.68e-05	7.49e-05	0.43 (0.05)	5.66e-05 ^a	7.50e-05 ^b	0.43 ^b	-	-	1.45e-03 ^a	1.58e-03 ^a	1.61e-03 ^a
	A4	5.66e-05	7.48e-05	0.43 (0.05)	5.64e-05 ^a	7.48e-05 ^b	0.43 ^b	-	-	1.44e-03 ^a	1.58e-03 ^a	1.60e-03 ^a
	A4 ^ω	4.92e-05	7.48e-05	0.40 (0.05)	4.91e-05 ^b	7.48e-05 ^b	0.40 ^c	-	-	1.35e-03 ^a	1.48e-03 ^a	1.50e-03 ^a
	G2	5.55e-05	6.96e-05	0.44 (0.04)	5.61e-05 ^a	6.96e-05 ^c	0.45 ^a	-	-	1.42e-03 ^a	1.50e-03 ^a	1.54e-03 ^a
	G4	2.99e-05	8.67e-05	0.26 (0.04)	3.13e-05 ^c	8.57e-05 ^a	0.27 ^d	-	-	9.76e-04 ^b	1.06e-03 ^b	1.08e-03 ^b
Fruit Circularity – lengthwise	A2	1.01e-04	6.99e-04	0.59 (0.04)	1.00e-04 ^a	7.01e-05 ^b	0.59 ^a	-	-	1.42e-03 ^a	1.26e-03 ^a	1.40e-03 ^a
	A4	1.01e-04	6.98e-04	0.59 (0.04)	9.98e-05 ^a	7.00e-05 ^b	0.59 ^a	-	-	1.42e-03 ^a	1.26e-03 ^a	1.40e-03 ^a
	A4 ^ω	8.74 e-05	6.98e-05	0.56 (0.05)	8.67e-05 ^b	6.99e-05 ^b	0.55 ^b	-	-	1.32e-03 ^{ab}	1.17e-03 ^{ab}	1.30e-03 ^{ab}
	G2	8.24e-05	8.69e-05	0.55 (0.04)	8.27e-05 ^c	6.68e-05 ^c	0.55 ^b	-	-	1.12e-03 ^b	9.88e-04 ^b	1.11e-03 ^b
	G4	4.91e-05	9.22e-05	0.35 (0.05)	5.10e-05 ^d	9.08e-05 ^a	0.36 ^c	-	-	8.42e-04 ^c	6.22e-04 ^c	7.91e-04 ^c