



Data analysis DVPRG 10 environments

**202050DVPRG_ciati, 202081DVPRG_momi,
202082DVPRG_pivi
202217DVPRG_momi, 202118DVPRG_momi,
202121DVPRG_repe, 202136DVPRG_ciati, 202218DVPRG_repe
202252DVPRG_stom, 202231DVPRG_ciati**

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Palmira, May 2022

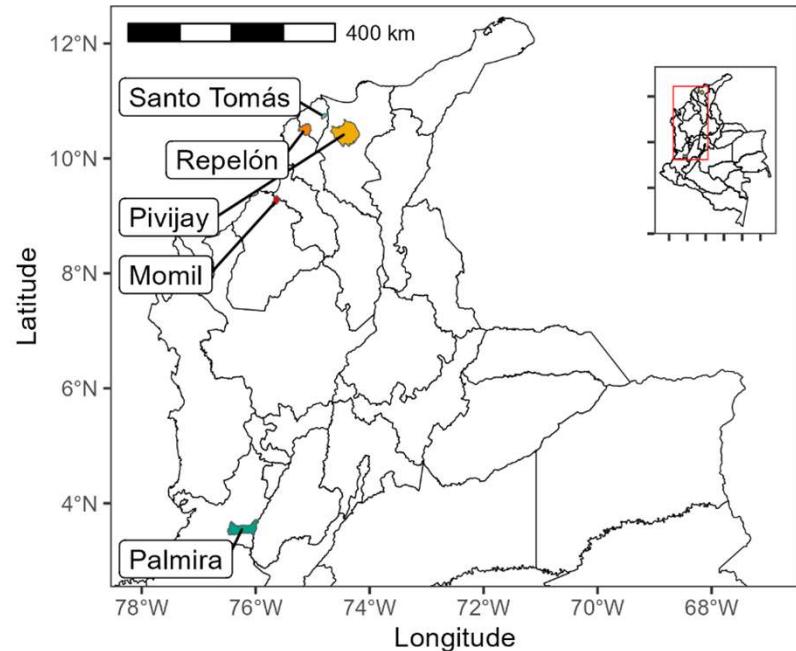


@BiovIntCIAT_eng
@BiovIntCIAT_esp

#Alliance4Science

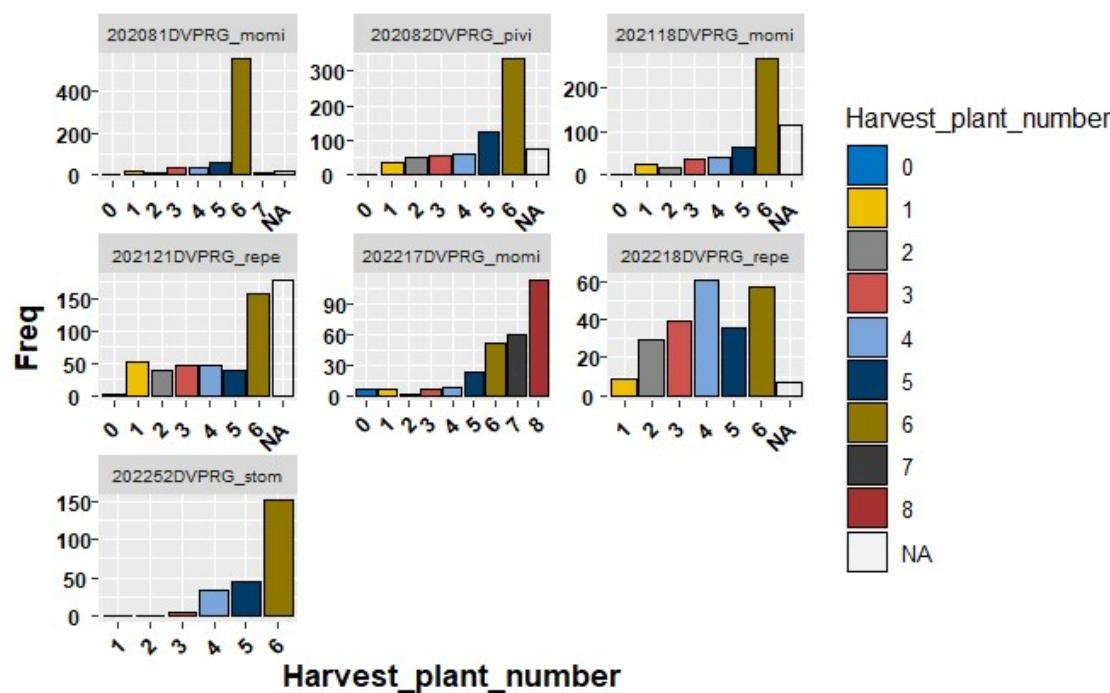
Resolvable row-col with randomized checks

use_trial_name	use_plant_date	use_harvest_date	harvesting_time	use_location	n_gen
202050DVPRG_ciat	2020-July-21	Not harvested		CIAT. Valle, Colombia	208
202081DVPRG_momi	2020-July-22	2021-May-03	9month 11day	Momil. Cordoba, Colombia	228
202082DVPRG_pivi	2020-July-08	2021-April-30	9month 22day	Pivijay. Magdalena, Colombia	226
202118DVPRG_momi	2021-May-20	2022-March-25	10month 5day	Momil. Cordoba, Colombia	181
202121DVPRG_repe	2021-June-01	2022-March-23	9month 22day	Repelon. Atlantico, Colombia	180
202136DVPRG_ciat	2021-July-29	2022-May-30	10month 1day	CIAT. Valle, Colombia	197
202217DVPRG_momi	2022-May-19	2023-March-02	9month 11day	Momil. Cordoba, Colombia	135
202218DVPRG_repe	2022-May-08	2023-February-21	9month 13day	Repelon. Atlantico, Colombia	117
202252DVPRG_stom	2022-June-30	2023-March-03	8month 3day	Santo Tomas. Atlantico, Colombia	117
202231DVPRG_ciat	2022-July-07	Hasn't yet been harvested		CIAT, Valle, Colombia	

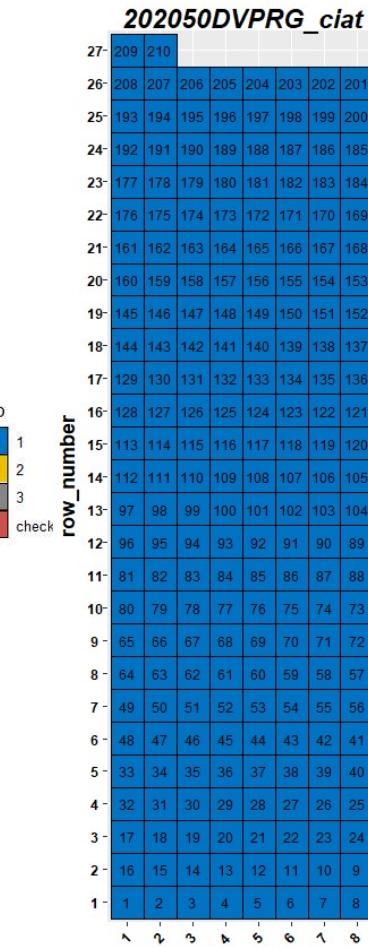
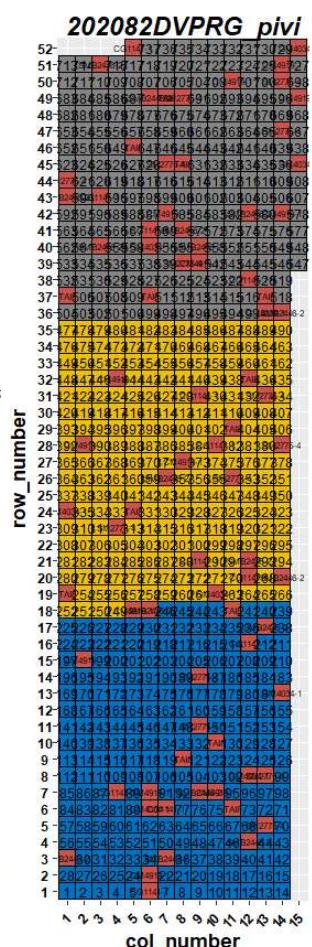
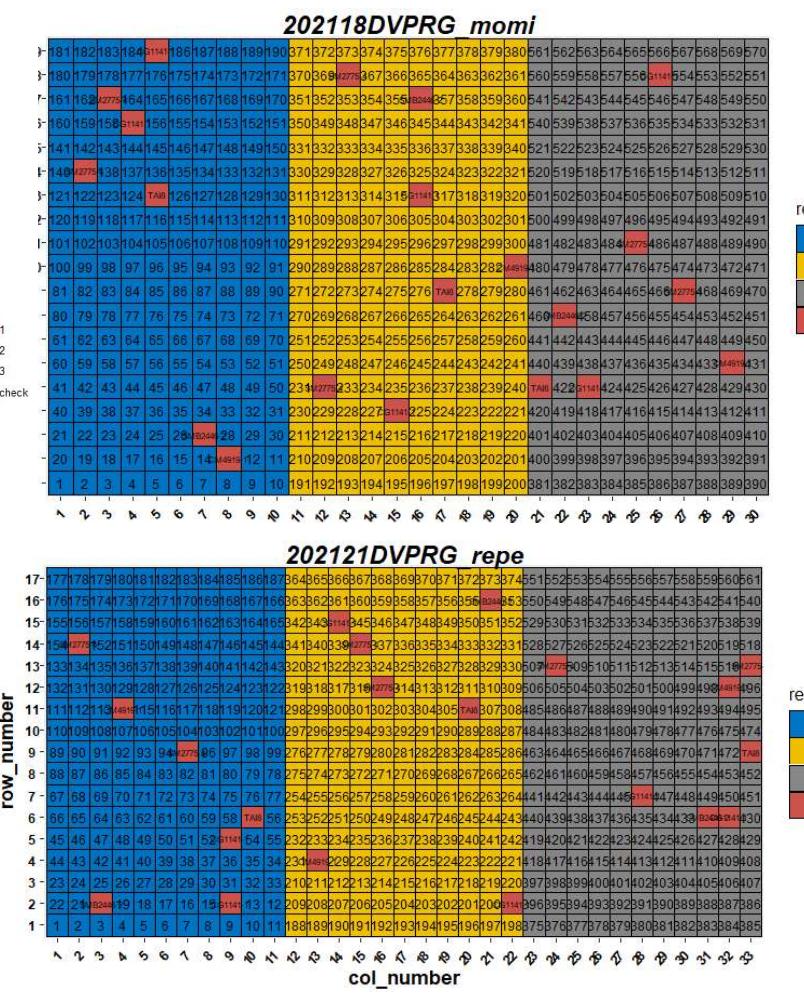
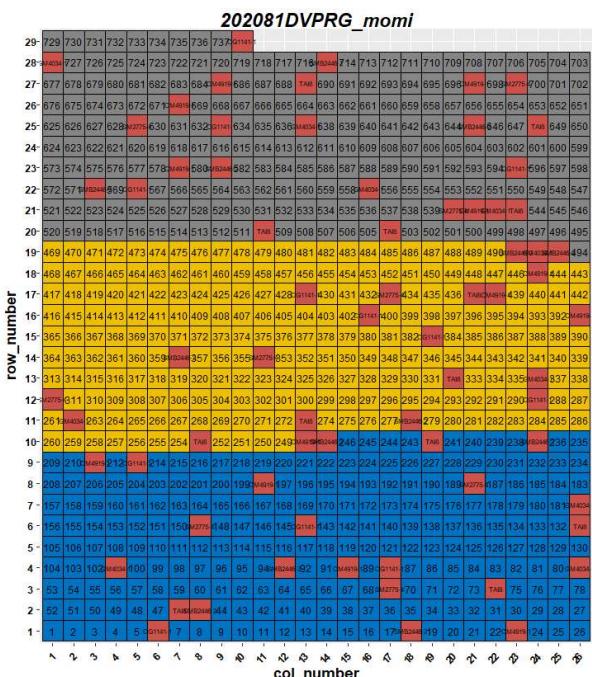


Plot size:

- 202081DVPRG_momi: **10** plants per plot, harvesting **6** plants for yield
- 202082DVPRG_pivi: **10** plants per plot, harvesting **6** plants for yield
- 202118DVPRG_momi: **10** plants per plot, harvesting **6** plants for yield
- 202121DVPRG_repe: **10** plants per plot, harvesting **6** plants for yield
- 202217DVPRG_momi: **10** plants per plot, harvesting **8** plants for yield
- 202218DVPRG_repe: **10** plants per plot, harvesting **6** plants for yield
- 202252DVPRG_stom: **10** plants per plot, harvesting **6** plants for yield



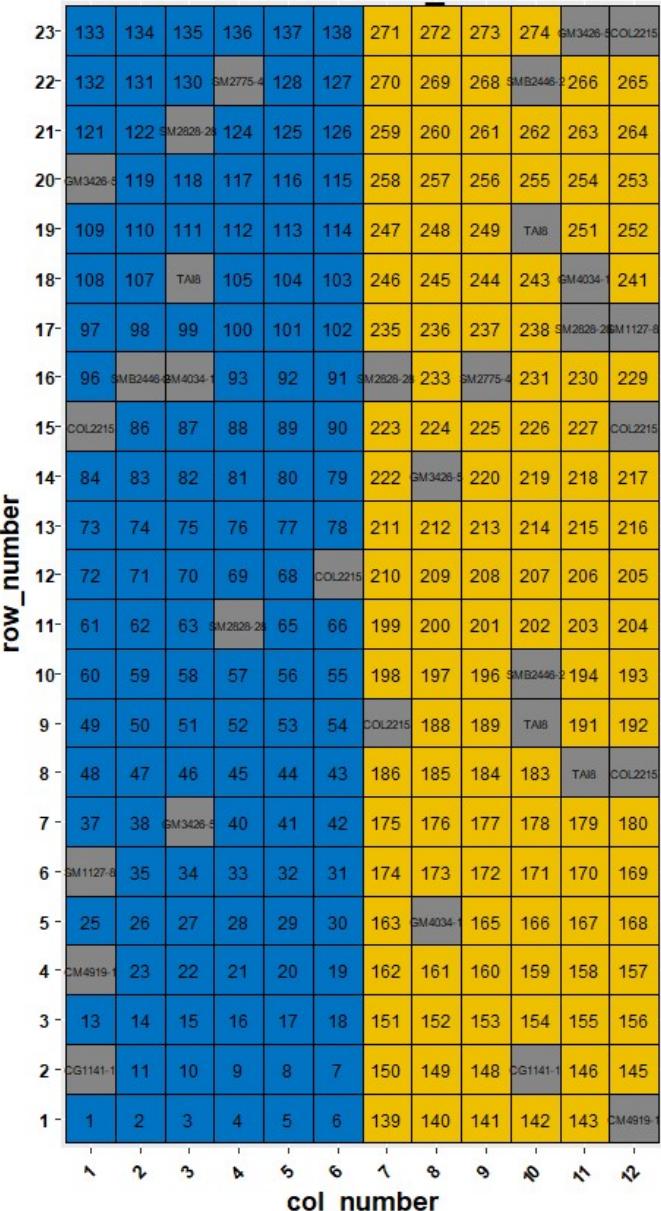
Trial Design – Row col



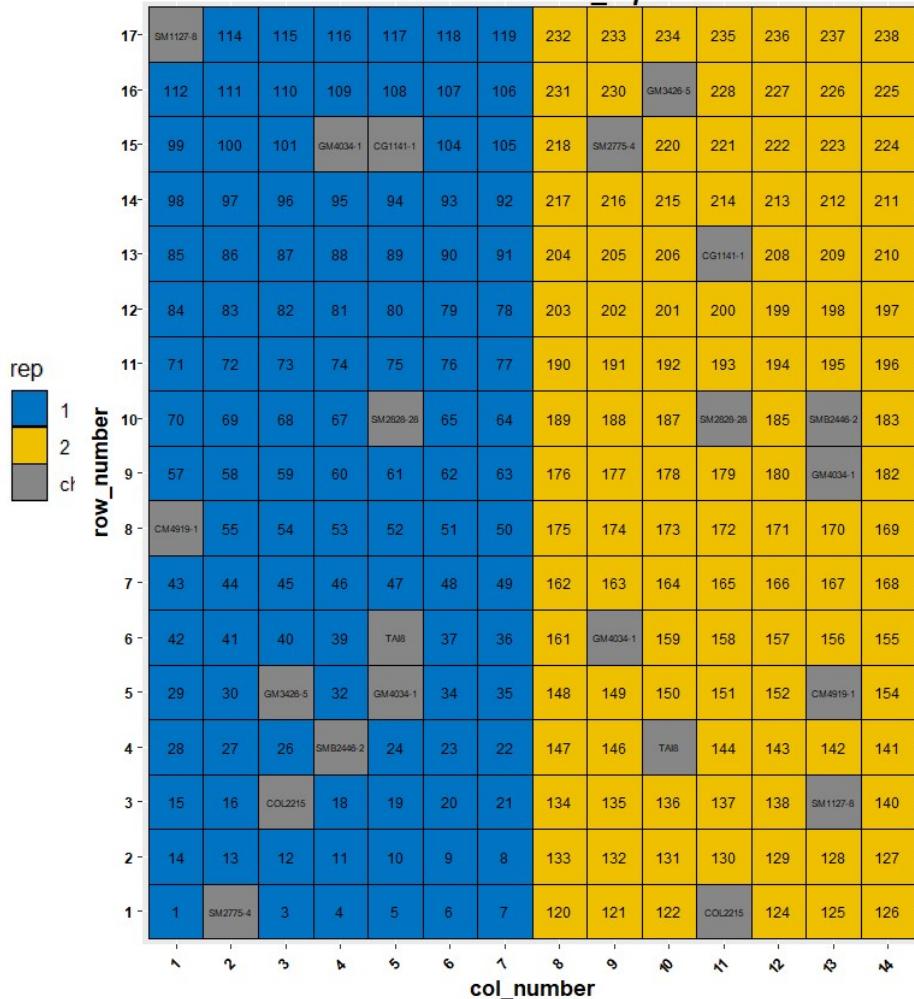
Trial Design – Row Group 2

Check varieties are completely randomized

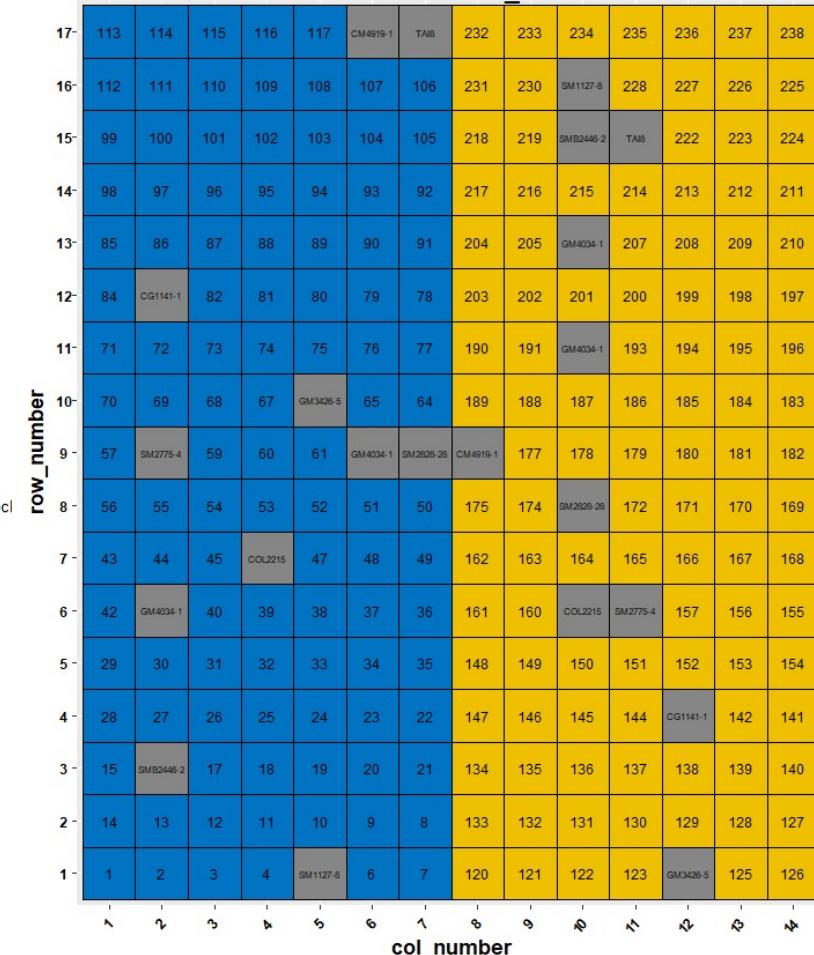
202217DVPRG_momi



202218DVPRG_repe



202252DVPRG_stom



Check genotypes

1. CG1141-1_is_Costena
2. CG489-31_is_NAT31
3. CM4919-1_is_Veronica
4. CM523-7_is_Catumare
5. CM6438-14_is_Vergara
6. CM6740-7_is_Reina
7. COL2215_is_Venezolana
8. GM4034-1_is_Reina_wx
9. HMC1P12_is_HMC1
10. SM1127-8_is_Cubana

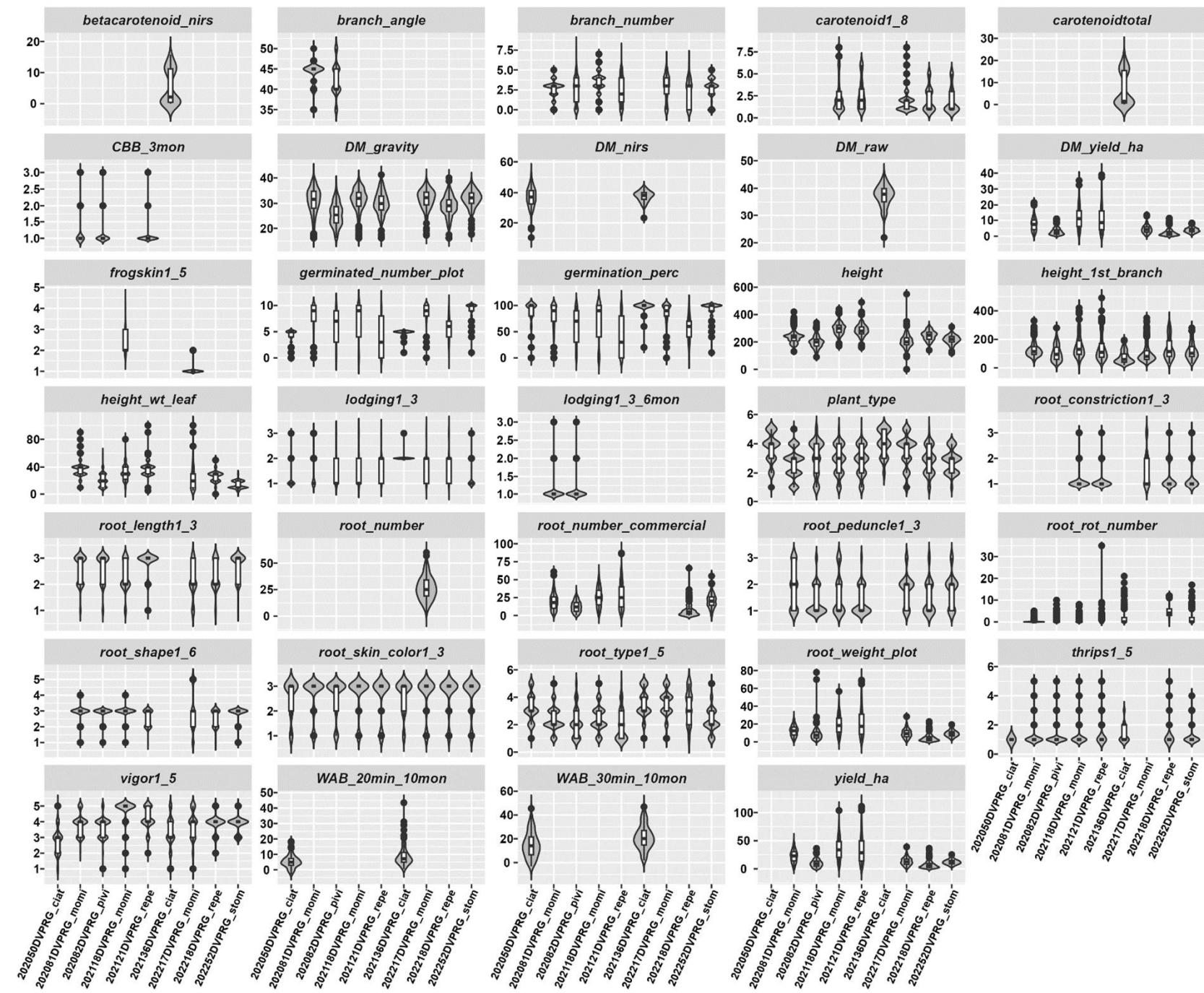


Exploratory data análisis

Traits evaluated

Traits evaluated	
betacarotenoid_nirs	lodging1_3_6mon
branch_angle	plant_type
branch_number	root_constriction1_3
carotenoid1_8	root_length1_3
carotenoidtotal	root_number
CBB_3mon	root_number_commercial
DM_gravity	root_peduncle1_3
DM_nirs	root_rot_number
DM_raw	root_shape1_6
DM_yield_ha	root_skin_color1_3
frogskin1_5	root_type1_5
germinated_number_plot	root_weight_plot
germination_perc	thrips1_5
height	vigor1_5
height_1st_branch	WAB_20min_10mon
height_wt_leaf	WAB_30min_10mon
lodging1_3	yield_ha

Trait variation across trials (phenotypic value)



Shared genotypes

Connectivity Matrix

202136DVPRG_ciat	15	15	15	157	157	196	192	189	197
202050DVPRG_ciat	15	15	15	159	158	200	194	208	189
202082DVPRG_pivi	16	16	16	177	176	222	226	194	192
202081DVPRG_momi	16	16	16	181	180	228	222	200	196
202121DVPRG_repe	13	13	13	180	180	180	176	158	157
202118DVPRG_momi	13	13	13	181	180	181	177	159	157
202252DVPRG_stom	117	117	117	13	13	16	16	15	15
202218DVPRG_repe	117	117	117	13	13	16	16	15	15
202217DVPRG_momi	135	117	117	13	13	16	16	15	15

The table shows a connectivity matrix for 10 different trials. The rows and columns are labeled with trial names. A blue oval highlights the first four rows (202136DVPRG_ciat, 202050DVPRG_ciat, 202082DVPRG_pivi, 202081DVPRG_momi) and the first four columns. The values in the matrix range from 13 to 197.

Due to the common number of genotypes, two trial groups were formed.

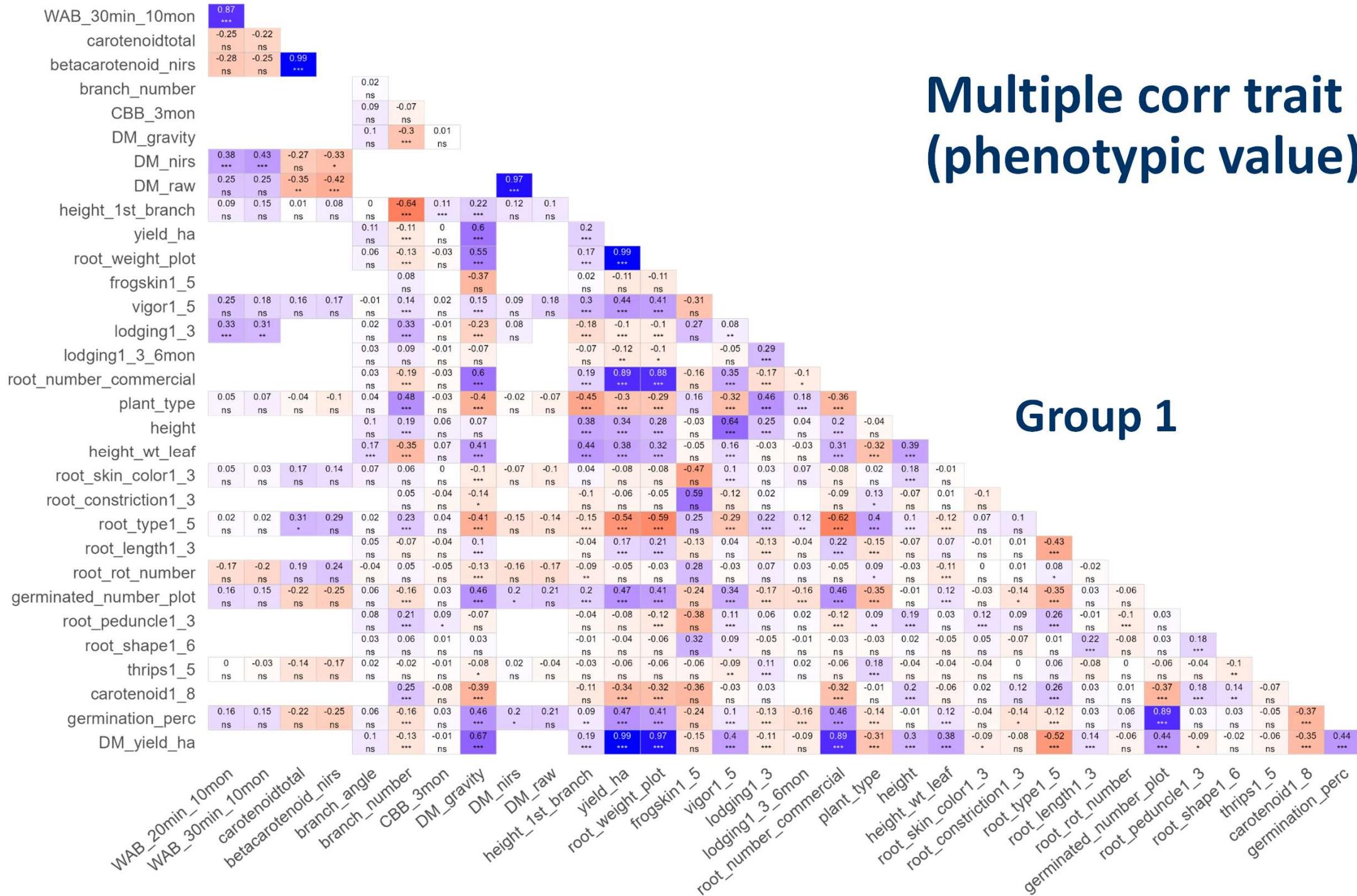
Group 1:

- 202050DVPRG_ciat
- 202081DVPRG_momi
- 202082DVPRG_pivi
- 202121DVPRG_repe
- 202118DVPRG_momi
- 202136DVPRG_ciat

Group 2:

- 202217DVPRG_momi
- 202218DVPRG_repe
- 202252DVPRG_stom

Multiple corr trait (phenotypic value)



Group 1

Multiple corr trait (phenotypic value)

	branch_number	DM_gravity	height_1st_branch	yield_ha	root_weight_plot	frogskin1_5	vigor1_5	lodging1_3	root_number_commercial	plant_type	height	height_wt_leaf	root_skin_color1_3	root_constriction1_3	root_type1_5	root_length1_3	root_number	root_rot_number	germinated_number_plot	root_peduncle1_3	root_shape1_6	thrips1_5	carotenoid1_8	germination_perc	DM_yield_ha																		
branch_number	0.02 ns	-0.82 ***	-0.08 ns																																								
DM_gravity		-0.02 ns	0.46 ***	-0.03 ns																																							
height_1st_branch			-0.01 ns	0.48 ***	-0.05 ns	0.99 ***																																					
yield_ha				0 ns	-0.18 ns	-0.07 ns	-0.09 ns	-0.09 ns																																			
root_weight_plot					0.08 ns	0.08 ns	0.05 ns	0.31 ***	0.3 ***	-0.03 ns																																	
frogskin1_5						0 ns	-0.18 ns	-0.07 ns	-0.09 ns	-0.09 ns																																	
vigor1_5							0.08 ns	0.08 ns	0.05 ns	0.31 ***	0.3 ***	-0.03 ns																															
lodging1_3								0.11 ns	-0.31 ***	-0.07 ns	-0.3 ***	-0.33 ***	0.06 ns	-0.02 ns																													
root_number_commercial									-0.03 ns	0.45 ***	-0.03 ns	0.84 ***	0.88 ***		0.17 ns	-0.47 ***																											
plant_type										0.49 ***	-0.13 ns	-0.52 ***	-0.14 *	-0.13 ns	0.14 ns	-0.15 *	0.44 ***	-0.21 **																									
height											-0.07 ns	-0.19 ***	0.4 ***	-0.11 ns	-0.15 *	-0.11 ns	0.34 ***	0.17 ***	-0.25 ***	-0.27 ***																							
height_wt_leaf												-0.31 ***	-0.07 ns	0.38 ***	-0.13 ns	-0.17 **	-0.05 ns	-0.09 ns	0.21 ***	-0.39 ***	-0.23 ***	0.31 ***																					
root_skin_color1_3													0.02 ns	0.08 ns	0.03 ns	0.02 ns	0 ns	0.06 ns	0.02 ns	-0.01 ns	-0.01 ns	0.16 **	0.02 ns																				
root_constriction1_3														0.2 ***	0.05 ns	-0.17 **	-0.01 ns	-0.01 ns	-0.01 ns	-0.07 ns	0.06 ns	-0.06 ns	0.14 *	-0.08 ns	0.06 ns	-0.24 ***																	
root_type1_5															0.15 *	-0.32 ***	-0.1 ns	-0.6 ***	-0.6 ***	0.11 ns	-0.25 ***	0.44 ***	-0.68 ***	0.34 ***	-0.01 ns	0.19 ***	-0.05 ns	0.34 ***															
root_length1_3																0.03 ns	0.13 ns	-0.03 ns	0.2 ***	0.21 ***	0.06 ns	-0.27 ***	0.4 ***	-0.18 ***	0.12 ns	-0.07 ns	-0.04 ns	0 ns	-0.46 ***														
root_number																	-0.14 ns	0.32 ***	0.07 ns	0.76 ***	0.76 ***	-0.05 ns	0.38 ***	-0.35 ***		-0.29 ***	0.02 ns	-0.1 ns	0.14 ns	-0.25 *	-0.69 ***	-0.01 ns											
root_rot_number																		-0.12 ns	-0.13 ns	0.17 ns	-0.11 ns	-0.19 **		0.18 *	0.22 ***	-0.26 ***	-0.13 ns	0.32 ***	0.39 ***	0.1 ns	-0.05 ns	0.12 ns	-0.21 **										
germinated_number_plot																		-0.06 ns	0.36 ***	-0.01 ns	0.51 ***	0.56 ***	0 ns	0.16 **	-0.3 ***	0.61 ***	-0.1 ns	-0.17 ***	-0.26 ***	-0.04 ns	0.01 ns	-0.32 ***	0.09 ns	0.48 ***	-0.17 ns								
root_peduncle1_3																			0.11 ns	0.06 ns	-0.1 ns	-0.03 ns	-0.01 ns	-0.13 ns	0.01 ns	-0.15 *	-0.03 ns	0.01 ns	-0.03 ns	-0.08 ns	0.18 ***	0.18 ***	0.13 ns	0.07 ns	-0.13 ns	0.12 ns							
root_shape1_6																			0.05 ns	0.01 ns	-0.05 ns	-0.16 **	-0.14 *	-0.02 ns	-0.18 ***	-0.04 ns	0.17 ns	0.05 ns	-0.03 ns	-0.06 ns	0.26 ***	0.2 ***	0.27 ***	-0.3 ***	-0.29 ***	0 ns	0.18 ***						
thrips1_5																			-0.1 ns	-0.2 **	0.04 ns	-0.08 ns	-0.07 ns		-0.22 ***	-0.02 ns	-0.05 ns	0.2 ns	-0.15 ns	-0.21 **	0.08 ns	-0.05 ns	0.07 ns	-0.09 ns									
carotenoid1_8																			0.07 ns	-0.23 ***	0 ns	-0.13 ns	-0.13 ns	-0.01 ns	0 ns	-0.11 ns	-0.11 ns	0.05 ns	-0.02 ns	-0.02 ns	-0.05 ns	0.09 ns	-0.03 ns	0.09 ns	-0.03 ns	0.04 ns	-0.13 ns	0.06 ns	0.07 ns	0 ns			
germination_perc																			-0.06 ns	0.36 ***	-0.01 ns	0.51 ***	0.56 ***	0 ns	0.16 **	-0.3 ***	0.61 ***	-0.1 ns	-0.17 ***	-0.26 ***	-0.04 ns	0.01 ns	-0.32 ***	0.09 ns	0.48 ***	-0.17 ns	1 ***	0.12 ns	0 ns	-0.01 ns	-0.13 ns		
DM_yield_ha																				-0.03 ns	0.59 ***	-0.03 ns	0.98 ***	0.98 ***	-0.1 ns	0.29 ***	-0.31 ***	0.83 ***	-0.15 ns	-0.13 ns	-0.12 ns	0.03 ns	-0.01 ns	-0.59 ***	0.2 ***	0.75 ***	-0.12 ns	0.51 ***	-0.01 ns	-0.15 *	-0.1 ns	-0.16 **	0.51 ***

Multiple corr trait (phenotypic value)

Group 2



Statistical data analysis

Single heritability

Moderate to high heritability showing the good trial management at 7 locations.

Group 1

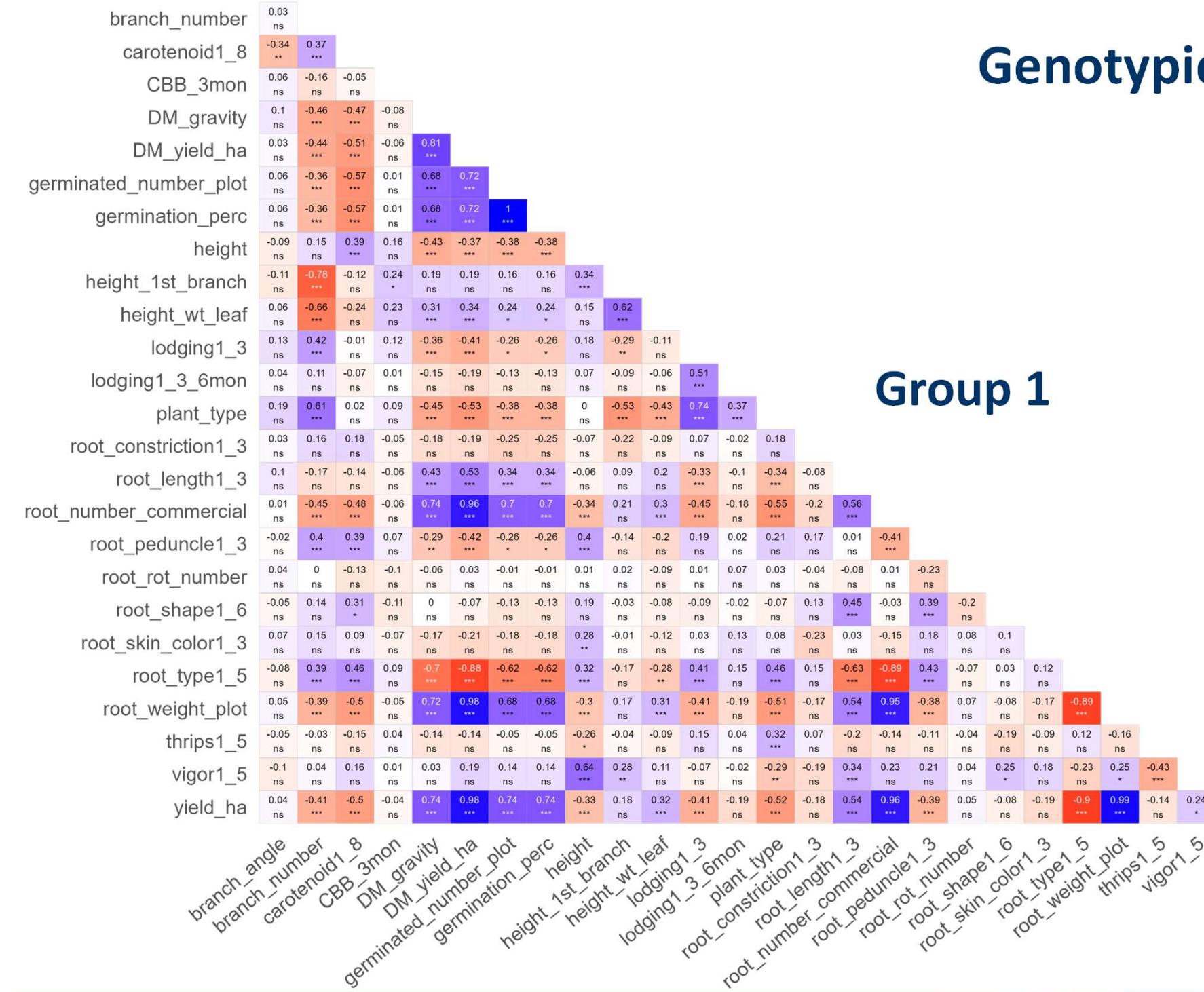
trial	branch_angle	branch_number	carotenoид1_8	CBB_3mon	DM_gravity	DM_yield_d_ha	germinated_number_plot	germination_perc	height_branch	height_1st_leaf	height_wt	lodging1_3	lodging1_3mon	plant_type	root_constriction1_3	root_length_h1_3	root_number_commercial	root_peduncle1_3	root_rotation_number	root_shape_e1_6	root_skin_color1_3	root_type_e1_5	root_weight_t_plot	thrips1_5	vigor1_5	yield_ha	
202081DVPRG_momi	0.5	0.89		0.22	0.95	0.88	0.87	0.87	0.89	0.84	0.64	0.85	0.73	0.88		0.5	0.82	0.72	0.23	0.58	0.97	0.78	0.85	0.86	0.72	0.86	
202082DVPRG_pivi	0.49	0.88		0.45	0.94	0.87	0.9	0.9	0.88	0.89	0.8	0.79	0.28	0.86		0.71	0.82	0.74	0.52	0.74	0.96	0.86	0.63	0.82	0.71	0.87	
202118DVPRG_momi		0.84	0.96		0.96	0.86	0.96	0.96	0.96	0.77	0.88	0.53	0.73		0.8	0.3	0.39	0.82	0.64	0.19	0.48	0.96	0.79	0.83	0.62	0.74	0.83
202121DVPRG_repe		0.92	0.94	0.01	0.91	0.84	0.92	0.92	0.88	0.88	0.7	0.71		0.83	0.34	0.67	0.8	0.51	0.01	0.52	0.98	0.78	0.83	0.81	0.67	0.83	

Group 2

trial	branch_number	carotenoид1_8	DM_gravity	DM_yield_ha	frogskin1_5	germinated_number_plot	germination_perc	height_branch	height_1st_leaf	height_wt	lodging1_3	plant_type	root_constriction1_3	root_length_h1_3	root_number_commercial	root_peduncle1_3	root_rotation_number	root_shape_e1_6	root_skin_color1_3	root_type_e1_5	root_weight_t_plot	thrips1_5	vigor1_5	yield_ha	
202217DVPRG_momi	0.88	0.92	0.81	0.6	0.58	0.74	0.74	0.5	0.89	0.58	0.75	0.87	0.6	0.49	0.62		0.66		0.49	0.98	0.61	0.61		0.57	0.61
202218DVPRG_repe	0.85	0.76	0.65	0.53		0.33	0.33	0.74	0.89	0.65	0.54	0.76	0.39	0.34		0.28	0.46	0	0.21	0.94	0.64	0.51	0.94	0.42	0.51
202252DVPRG_stom	0.89	0.9	0.84	0.83		0.68	0.68	0.81	0.92	0.51	0.42	0.66	0.67	0.31		0.72	0.85	0.24	0.48	0.98	0.79	0.8	0.78	0.42	0.8

Genotypic correlation

Group 1



Genotypic correlation

Group 2

	branch_number	carotenoid1_8	DM_gravity	DM_yield_ha	germinated_number_plot	germination_perc	height	height_1st_branch	height_wt_leaf	lodging1_3	plant_type	root_constriction1_3	root_length1_3	root_number_commercial	root_peduncle1_3	root_shape1_6	root_skin_color1_3	root_type1_5	root_weight_plot	thrips1_5	vigor1_5	yield_ha												
carotenoid1_8		0.09 ns	-0.08 ns	-0.35 **																														
DM_gravity			-0.24 ns	-0.28 ns	0.63 ***																													
DM_yield_ha				-0.31 *	-0.3 ns	0.38 **	0.5 ***																											
germinated_number_plot					-0.31 *	-0.3 ns	0.38 **	0.5 ***	1 ***																									
germination_perc						-0.03 ns	0.13 ns	-0.21 ns	-0.14 ns	-0.18 ns	-0.18 ns																							
height							-0.9 ***	-0.01 ns	0.01 ns	0.15 ns	0.24 ns	0.24 ns	0.3 ns																					
height_1st_branch								-0.52 ***	-0.03 ns	0.16 ns	0.16 ns	0.02 ns	0.02 ns	0.29 ns	0.58 ***																			
height_wt_leaf									-0.32 *	-0.39 ***	-0.2 ns	-0.2 ns	0.22 ns	-0.1 ns	0 ns																			
lodging1_3										0.18 ns	-0.03 ns	-0.31 *	-0.44 ***	-0.32 *	-0.32 *	-0.11 ns	-0.62 ***	-0.43 ***	0.59 ***															
plant_type											0.65 ***	-0.11 ns	-0.31 *	-0.44 ***	-0.32 *	-0.32 *	-0.11 ns	-0.62 ***	-0.43 ***	0.59 ***														
root_constriction1_3											0.28 ns	-0.13 ns	0.02 ns	-0.15 ns	-0.12 ns	-0.12 ns	0 ns	-0.24 ns	-0.01 ns	-0.05 ns	0.13 ns													
root_length1_3											0.06 ns	-0.04 ns	0.29 ns	0.34 **	0.02 ns	0.02 ns	0.14 ns	-0.08 ns	0.16 ns	-0.28 ns	-0.25 ns	0.21 ns												
root_number_commercial												-0.35 *	-0.16 ns	0.43 ***	0.82 ***	0.48 ***	0.48 ***	-0.11 ns	0.27 ns	0.18 ns	-0.37 **	-0.5 ***	-0.17 ns	0.14 ns										
root_peduncle1_3													0.19 ns	0.06 ns	-0.03 ns	-0.3 ns	-0.14 ns	-0.14 ns	0.07 ns	-0.14 ns	-0.05 ns	-0.24 ns	0 ns	0.41 ***	0.24 ns	-0.3 ns								
root_shape1_6													0.12 ns	0.1 ns	-0.07 ns	-0.33 *	-0.27 ns	-0.27 ns	0.1 ns	-0.1 ns	0.09 ns	-0.03 ns	0.02 ns	0.33 *	0.3 ns	-0.34 *	0.49 ***							
root_skin_color1_3													0.03 ns	0.02 ns	0.1 ns	0.03 ns	-0.05 ns	-0.05 ns	0.16 ns	0.05 ns	0.02 ns	-0.03 ns	0.01 ns	-0.4 ***	0 ns	-0.01 ns	-0.14 ns	-0.09 ns						
root_type1_5														0.26 ns	0.16 ns	-0.46 ***	-0.85 ***	-0.42 ***	-0.42 ***	0.09 ns	-0.18 ns	-0.09 ns	0.32 *	0.4 ***	0.34 **	-0.28 ns	-0.75 ***	0.47 ***	0.45 ***	-0.13 ns				
root_weight_plot														-0.23 ns	-0.24 ns	0.5 ***	0.98 ***	0.51 ***	0.51 ***	-0.11 ns	0.15 ns	0.11 ns	-0.37 **	-0.41 ***	-0.19 ns	0.32 *	0.84 ***	-0.34 *	-0.38 ***	0.03 ns	-0.67 ***			
thrips1_5														-0.12 ns	0.04 ns	-0.24 ns	-0.1 ns	-0.09 ns	-0.09 ns	-0.14 ns	0.08 ns	-0.16 ns	-0.06 ns	0.09 ns	-0.12 ns	-0.02 ns	0.04 ns	-0.01 ns	0.04 ns	0.07 ns	0.01 ns	-0.06 ns		
vigor1_5														0.07 ns	0.02 ns	0.1 ns	0.35 **	0.21 ns	0.21 ns	0.41 ***	0.03 ns	-0.07 ns	-0.12 ns	0.05 ns	0.31 *	0.22 ns	-0.07 ns	-0.1 ns	0.07 ns	-0.33 *	0.4 ***	-0.11 ns		
yield_ha														-0.23 ns	-0.24 ns	0.5 ***	0.98 ***	0.51 ***	0.51 ***	-0.1 ns	0.15 ns	0.11 ns	-0.37 **	-0.41 ***	-0.19 ns	0.32 *	0.84 ***	-0.33 *	-0.38 ***	0.03 ns	-0.87 ***	1 ***	-0.06 ns	0.4 ***

Heritability gxe

Group 1

Trait	h2
root_skin_color1_3	0.98
carotenoid1_8	0.97
DM_gravity	0.97
branch_number	0.93
height	0.92
germination_perc	0.91
germinated_number_plot	0.91
height_1st_branch	0.91
plant_type	0.9
root_type1_5	0.89
thrips1_5	0.88
DM_yield_ha	0.87
yield_ha	0.85
root_number_commercial	0.85
lodging1_3	0.85
root_peduncle1_3	0.83
root_weight_plot	0.81
height_wt_leaf	0.75
root_length1_3	0.71
vigor1_5	0.68
root_shape1_6	0.63
branch_angle	0.56
root_constriction1_3	0.41
CBB_3mon	0.4
lodging1_3_6mon	0.01
root_rot_number	-0.08

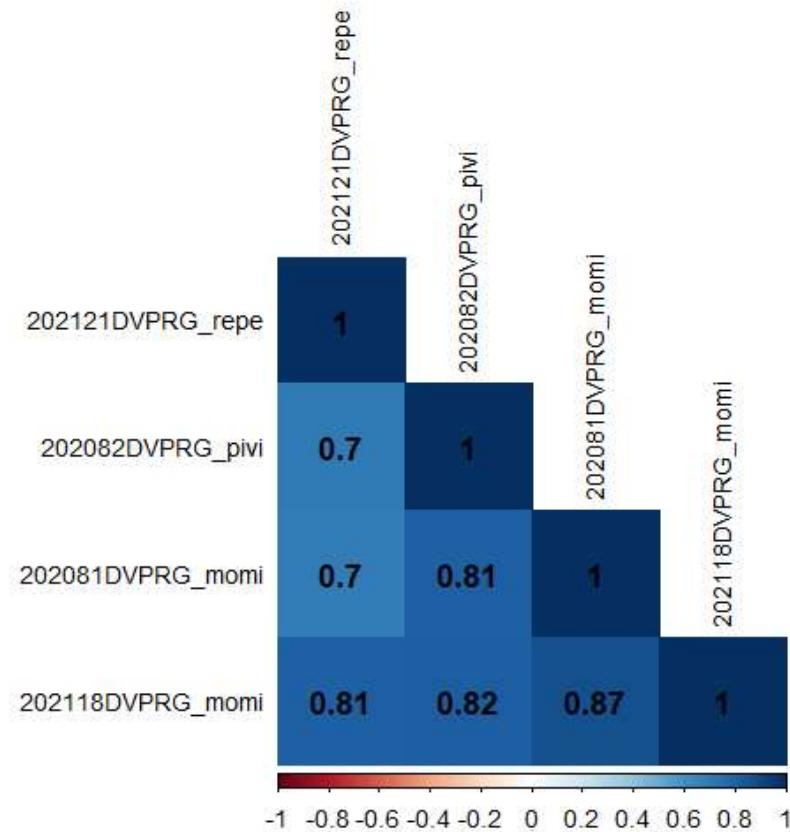
Group 2

trait	h2
root_skin_color1_3	0.99
thrips1_5	0.94
carotenoid1_8	0.94
branch_number	0.92
height_1st_branch	0.9
DM_gravity	0.87
plant_type	0.81
root_peduncle1_3	0.76
DM_yield_ha	0.76
root_type1_5	0.75
root_weight_plot	0.72
yield_ha	0.72
height	0.72
germinated_number_plot	0.72
germination_perc	0.72
root_number_commercial	0.71
root_constriction1_3	0.67
lodging1_3	0.65
height_wt_leaf	0.47
root_length1_3	0.43
vigor1_5	0.25
root_shape1_6	0.1

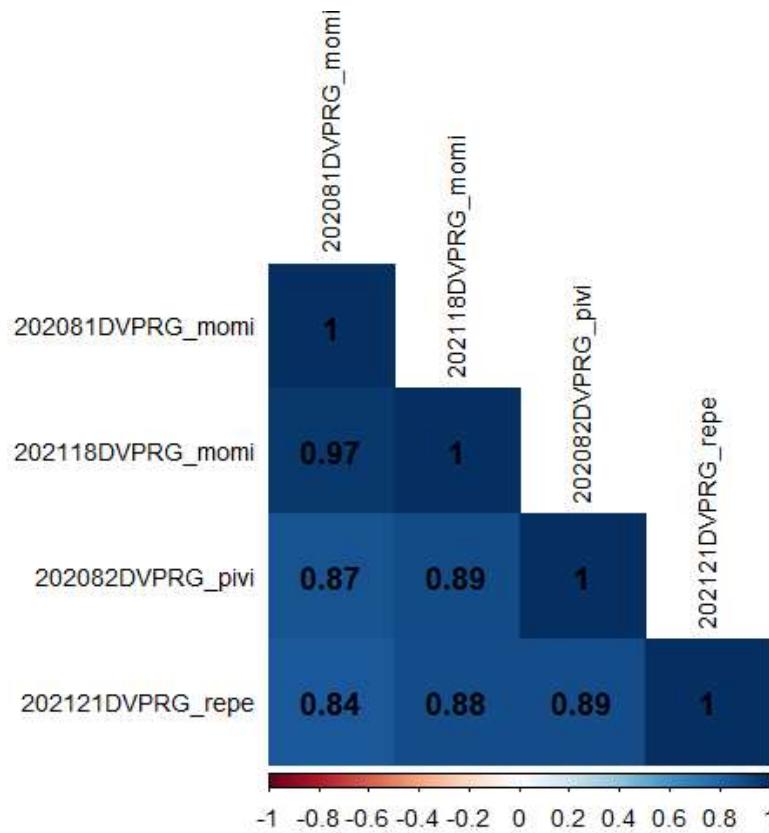
For traits with low heritability also in Group 1 and Group 2, please be careful. (blue square)

Genotypic Correlation: Locations Group 1

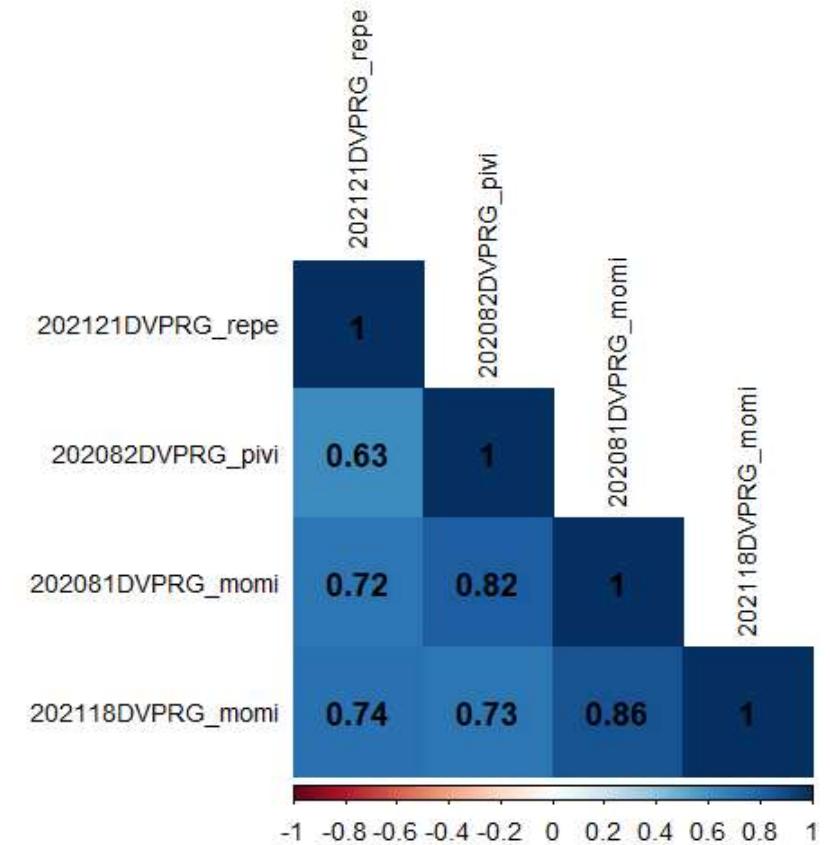
Yield



Dry Matter

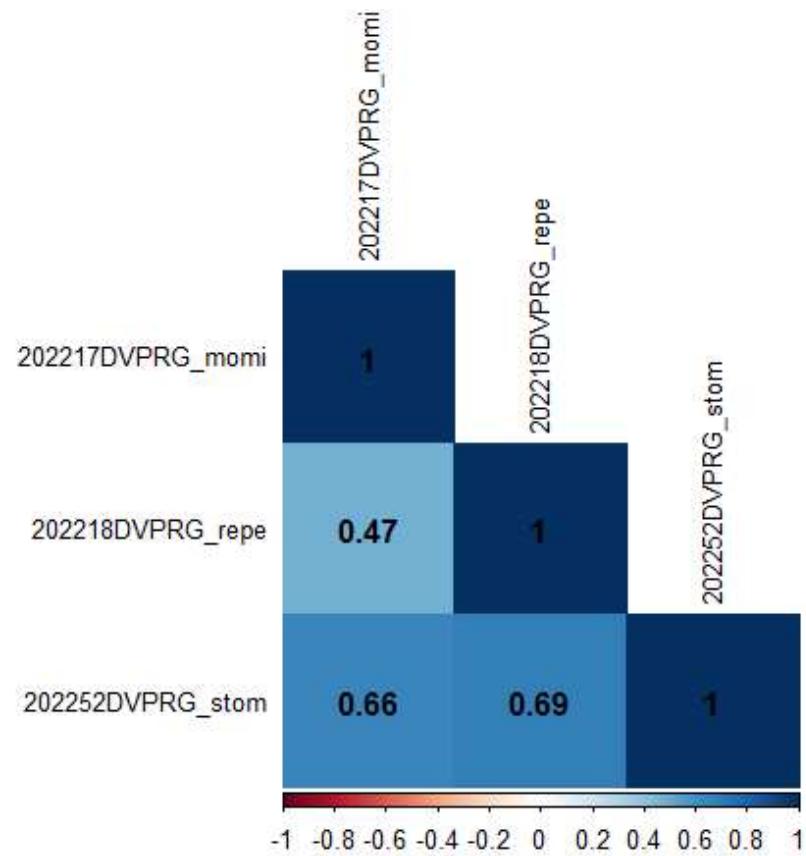


Plant type

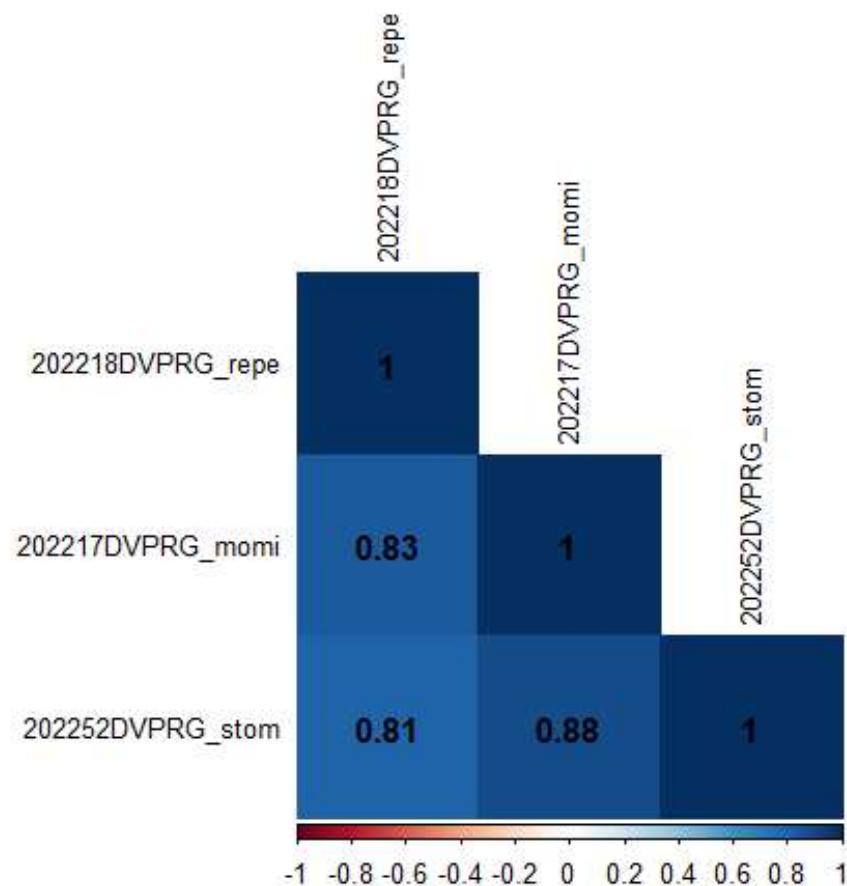


Genotypic Correlation: Locations Group 2

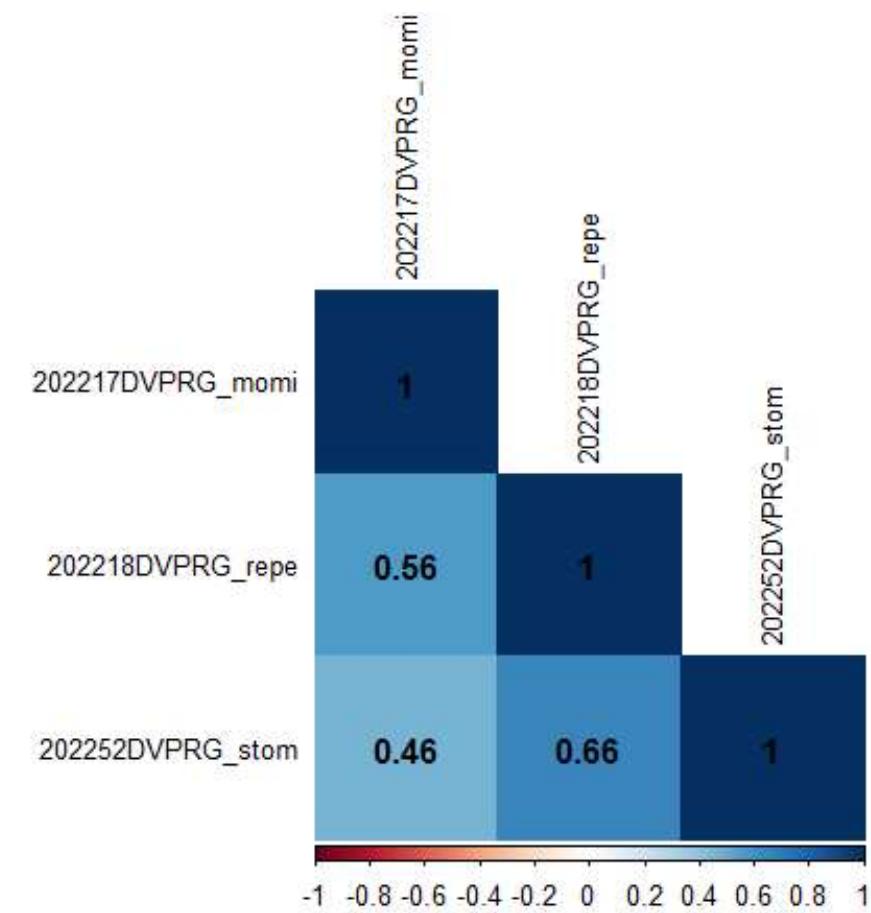
Yield



Dry Matter



Plant type



Selection comments

- 1) **DM_gravity, plant_type & yield_ha** were used to calculate index selection.
- 2) Scores given were:
 - DM_gravity = 10
 - plant_type = -5
 - yield_ha = 10
- 3) Percentage to be selected: **20%**



Thank you!