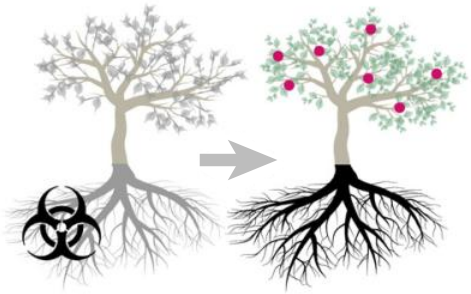
Inheritance of rootstock effects in avocado cv. Hass

Paula Reyes, Andrés J. Cortés, Laura Muñoz, Valeria Velázquez, Laura Patiño, Oscar Delgado, Cipriano Díaz, Alejandro Navas

acortes@agrosavia.co

Grafting: Rootstock – Scion Interaction

GENETIC CHIMERAS



Root pest/pathogen resistance

Warschefsky *et al.* 2015

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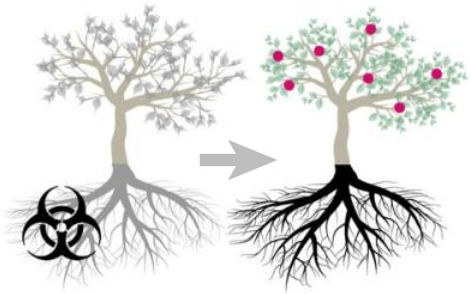

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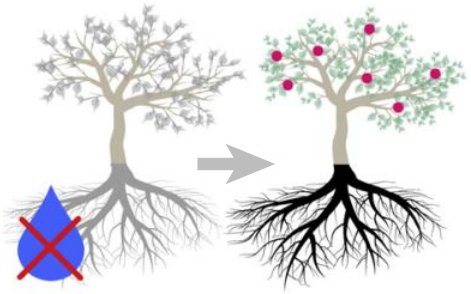

Abiotic stress tolerance (drought, flooding, salt, soil conditions)

Warschefsky *et al.* 2015

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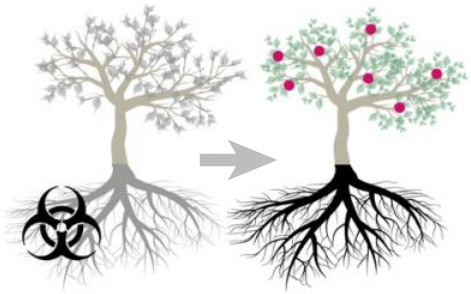

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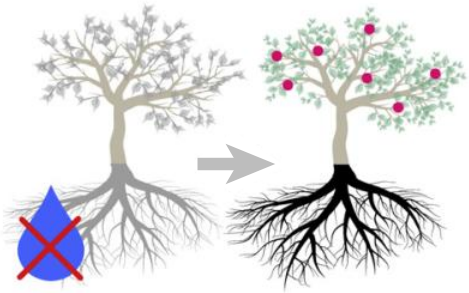

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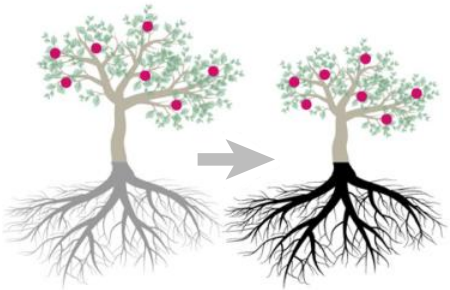

Dwarfing

Warschefsky *et al.* 2015

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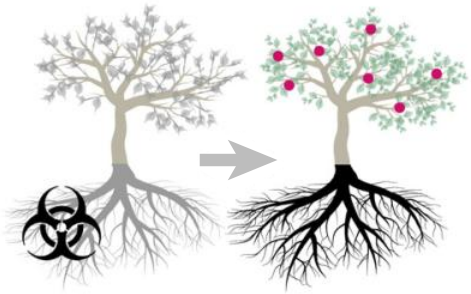

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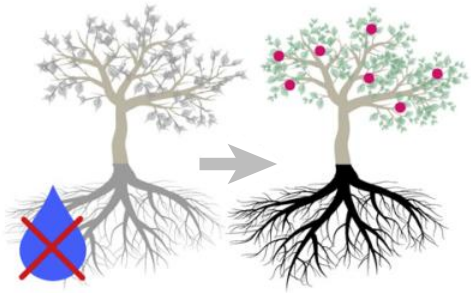

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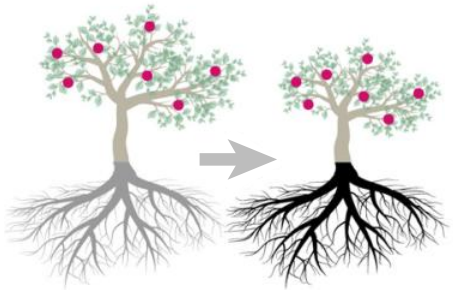

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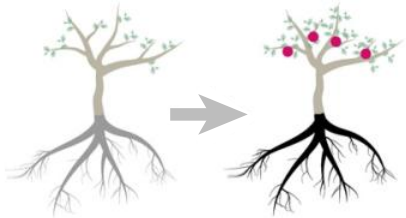
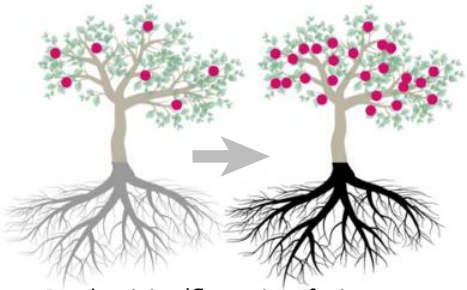


Precocity



Productivity (flowering, fruit set, fruit weight, overall yield)

Warschefsky *et al.* 2015

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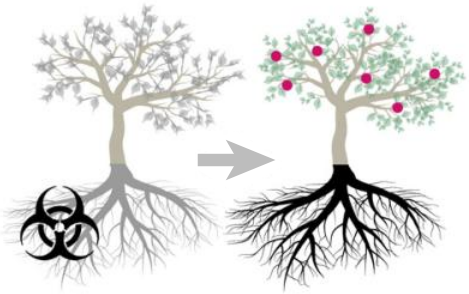
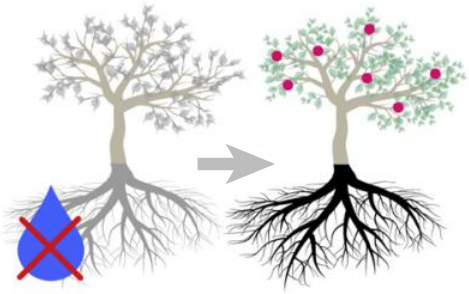
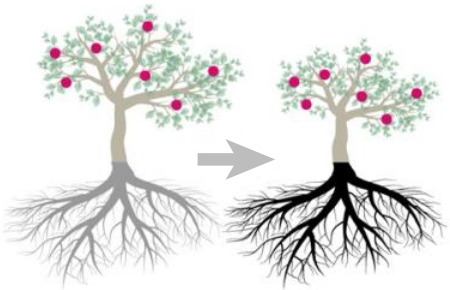


Root pest/pathogen resistance



Abiotic stress tolerance (drought, flooding, salt, soil conditions)



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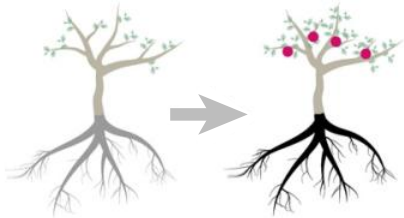

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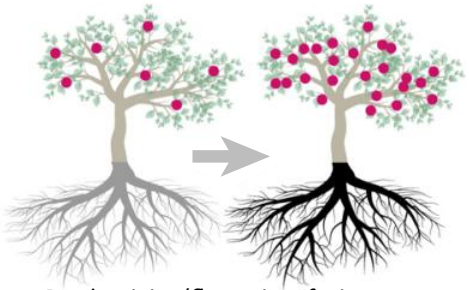

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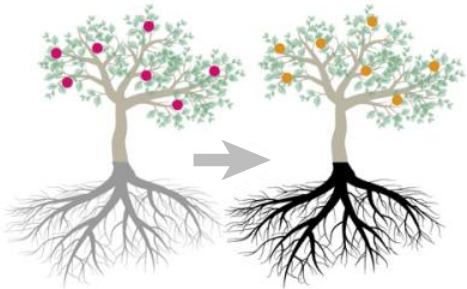
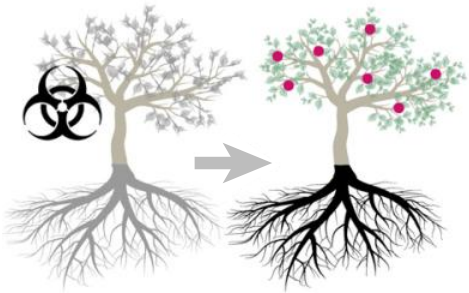
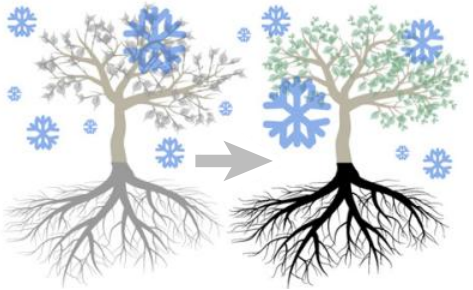


Fruit quality (texture, sugar and nutrient content, weight, acidity, pH, flavor, and color)



Shoot pest/pathogen resistance



Cold tolerance

Warschefsky *et al.* 2015

Grafting: Rootstock – Scion Interaction

ROOTSTOCK PROPERTIES IN AVOCADO

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HortScience 54(5):809–813. 2019. https://doi.org/10.21273/HORTSCI13552-18

Screening Progenies of Mexican Race Avocado Genotypes for Resistance to *Phytophthora cinnamomi* Rands

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Universidad Autónoma Chapingo, Departamento de Fitotecnia, Chapingo, Estado de Mexico, 56230 Mexico

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J. Amer. Soc. Hort. Sci. 127(4):649–655. 2002.

Rootstock Influences Changes in Ion Concentrations, Growth, and Photosynthesis of 'Hass' Avocado Trees in Response to Salinity

Michael V. Mickelbart[1] and Mary Lu Arpaia[2]
Department of Botany and Plant Sciences, University of California, Riverside CA 92521

Grafting: Rootstock – Scion Interaction

ROOTSTOCK EFFECTS IN AVOCADO

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Journal of Horticultural Science & Biotechnology (2007) **82** (3) 460–466

Effects of clonal rootstocks on 'Hass' avocado yield components, alternate bearing, and nutrition

By MICHAEL V. MICKELBART[1,3*], GARY S. BENDER[2], GUY W. WITNEY[1,4], CAROL ADAMS[5] and MARY LU ARPAIA[1,6]

Grafting: Rootstock – Scion Interaction

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CHILEANJAR
CHILEAN JOURNAL of AGRICULTURAL RESEARCH

SCIENTIFIC NOTE

Rootstock affects the blend of biogenic volatile organic compounds emitted by 'Hass' avocado

Ricardo Ceballos[1], and Tommy Rioja[2,3*]

Grafting: Rootstock – Scion Interaction

SCION EFFECTS IN AVOCADO

AGROSAVIA
Corporación colombiana de investigación agropecuaria

ARCHIVES OF AGRONOMY AND SOIL SCIENCE, 2017
VOL. 63, NO. 14, 1951–1962
https://doi.org/10.1080/03650340.2017.1317921

Taylor & Francis
Taylor & Francis Group

Effects of avocado (*Persea americana* Mill.) scion on arbuscular mycorrhizal and root hair development in rootstock

Bo Shu, Liqin Liu, Dengwei Jue, Yicheng Wang, Yongzan Wei and Shengyou Shi

North – West Andes

SAMPLING: 8 PLANTATIONS, 240TREES

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Quantify inheritance of rootstock effects on ‘Hass’ avocado

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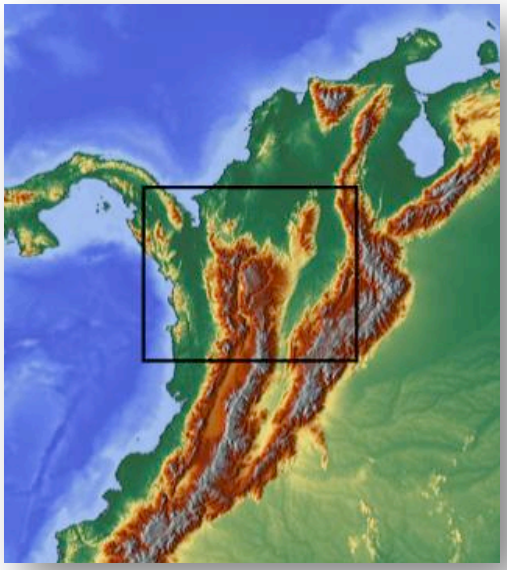

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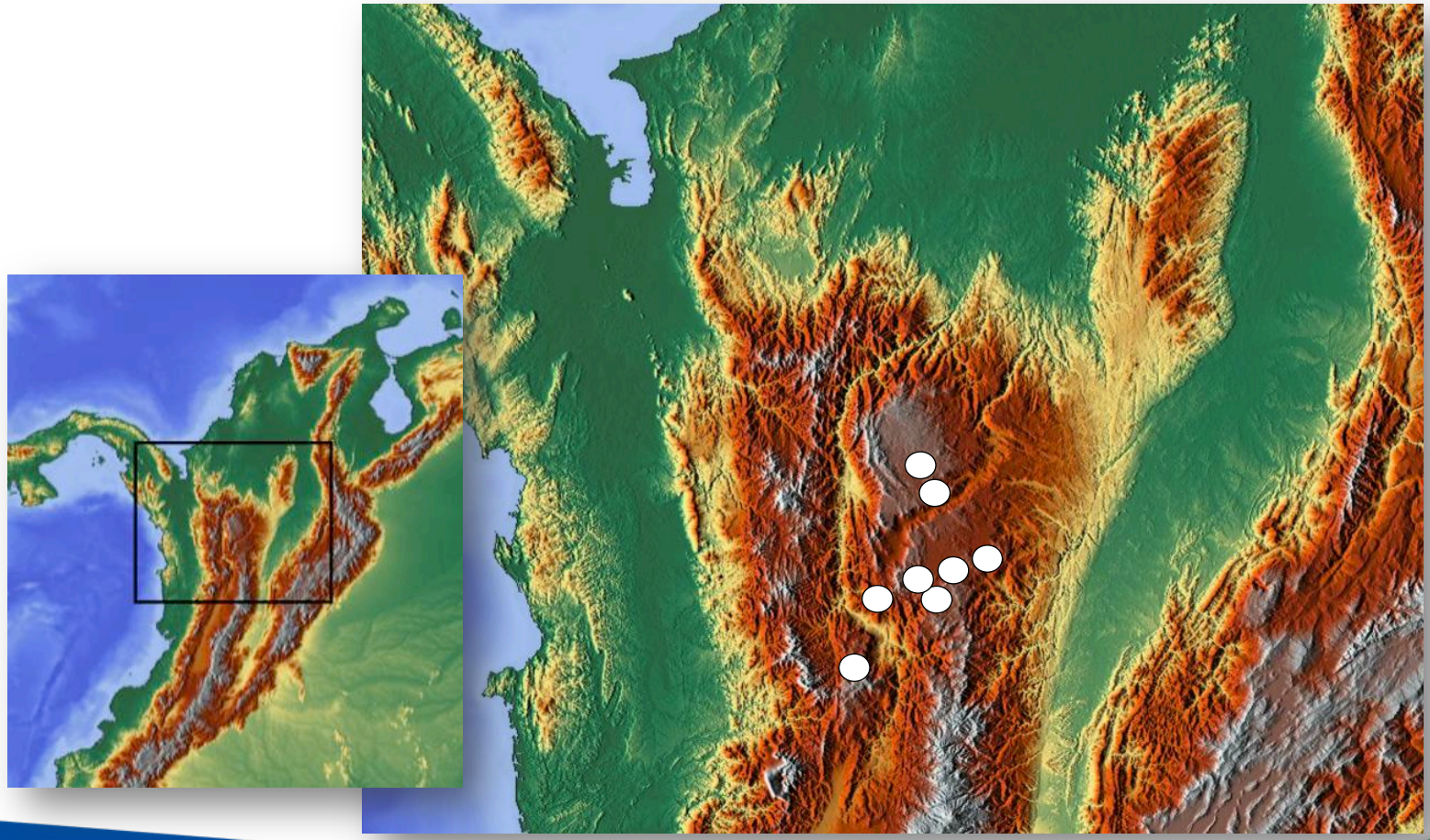

Rootstock–Mediated Heritabilities (h^2)

ANIMAL MODEL: 13 SSRs + 20 TRAITS

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Type of trait	Years	Trees	Number of traits	Phenotypic traits
Morphological	2016	240	8	Tree height
				Trunk height
				Rootstock height
				Scion lenght
				Rootstock perimeter
				Scion perimeter
				Trunk perimeter under graft scar
				Rootstock compatibility

Sharon *et al.* 1997

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Ecophysiological	2015 2016 2017	144	3	Number of flowers Number of fruits (NF) Leaves

Sharon *et al.* 1997

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				Scion lenght
				Rootstock perimeter
				Scion perimeter
				Trunk perimeter under graft scar
				Rootstock compatibility
Ecophysiological	2015 2016 2017	144	3	Number of flowers
				Number of fruits (NF)
				Leaves
Harvest	2015 2016 2017	161	9	NF with low weight
				NF with mechanical damage
				NF with exportation quality
				NF with sun damage
				NF with damage caused by scarab beetles
				NF with maturity
				NF with damage caused by thrips
				NF with damage caused by *Monalonion spp*
				NF with stem cut below the fruit

Sharon *et al.* 1997

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Trait *i* Value ← $y_i =$

Butler *et al.* 2007

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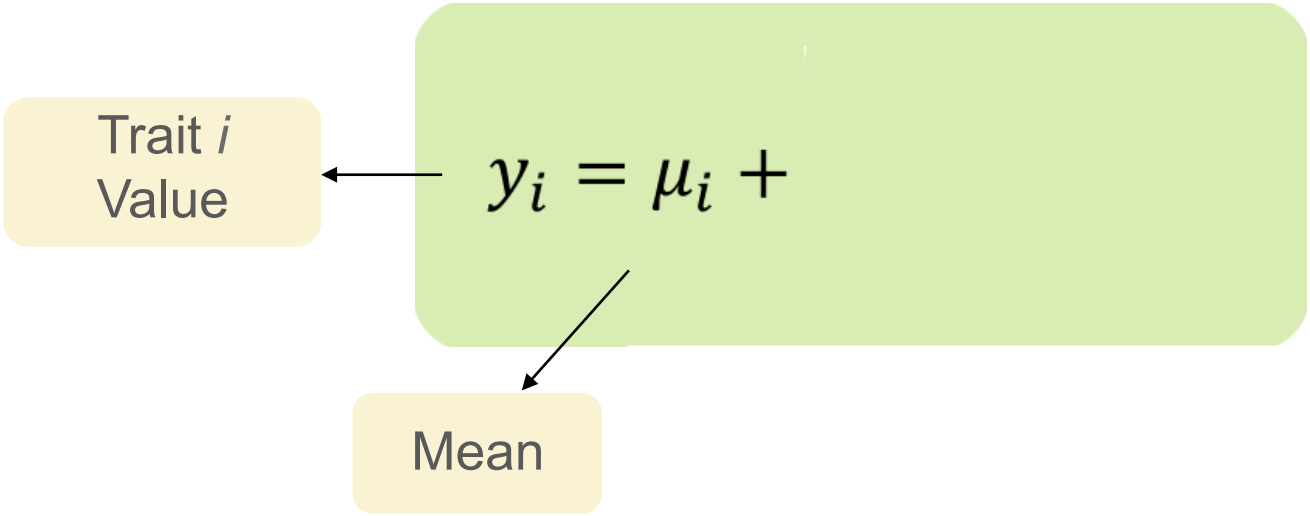

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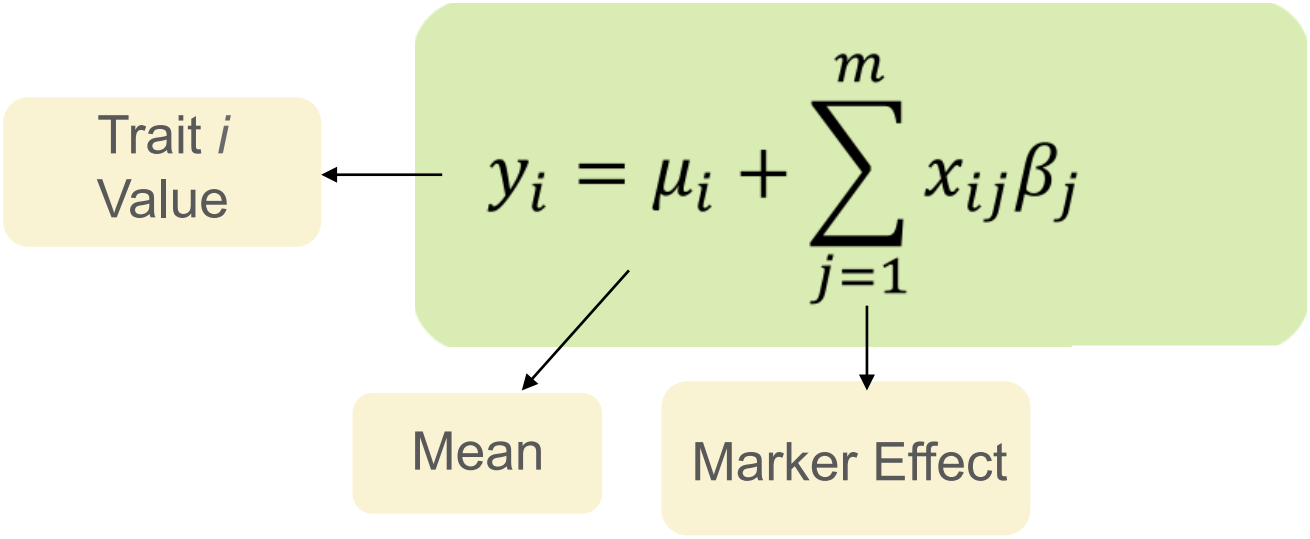

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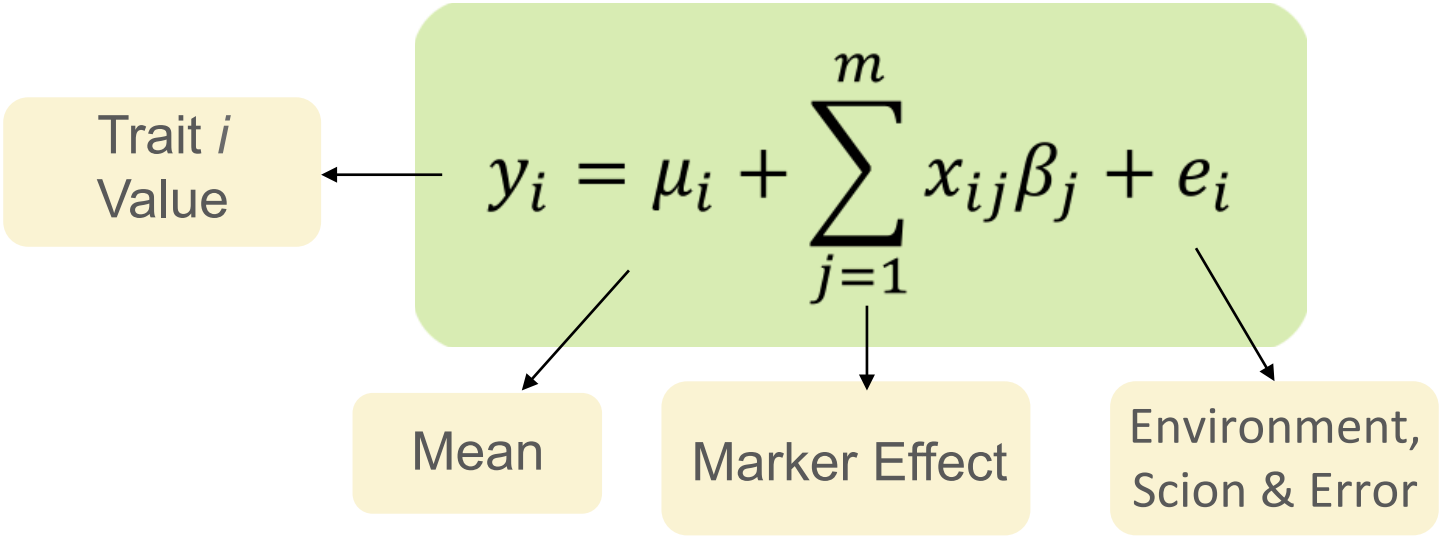

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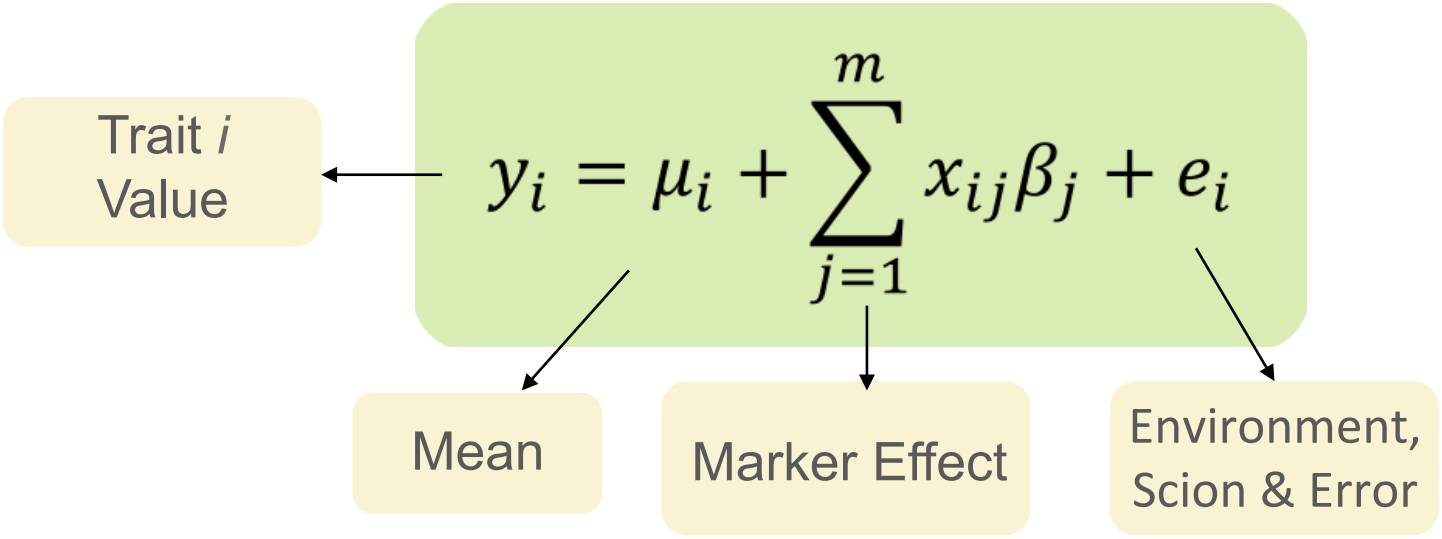

$$u_i = \sum_{j=1}^{m} x_{ij}\beta_j$$

Butler *et al.* 2007

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Trait *i* Value

$$y_i = \mu_i + \sum_{j=1}^{m} x_{ij}\beta_j + e_i$$

Mean

Marker Effect

Environment, Scion & Error

$$u_i = \sum_{j=1}^{m} x_{ij}\beta_j$$

$$h_i^2 = \frac{Var(u_i)}{Var(u_i) + Var(e_i)}$$

Butler *et al.* 2007

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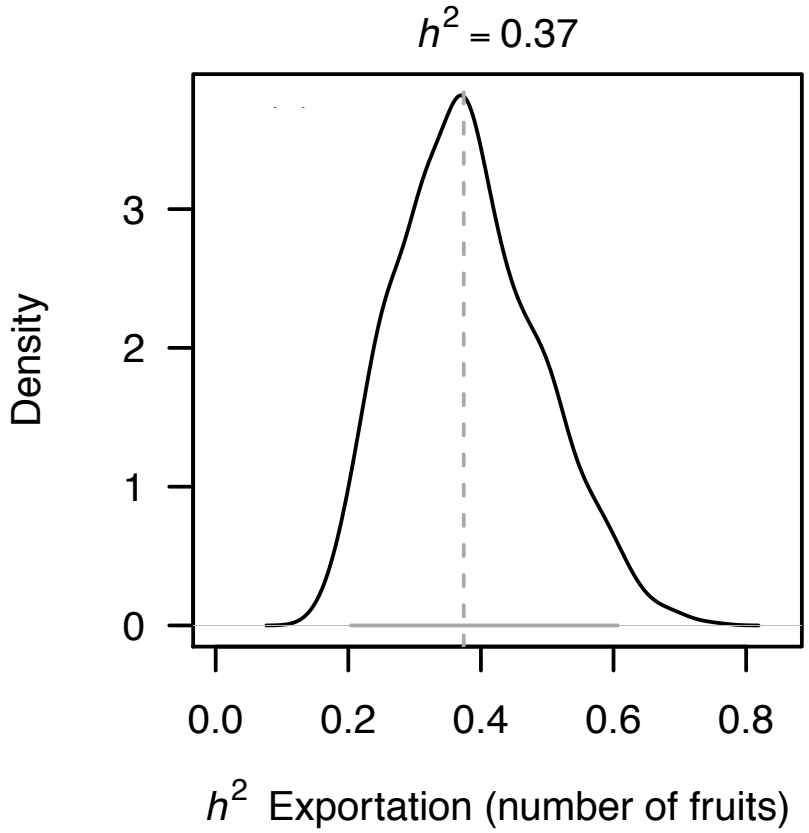

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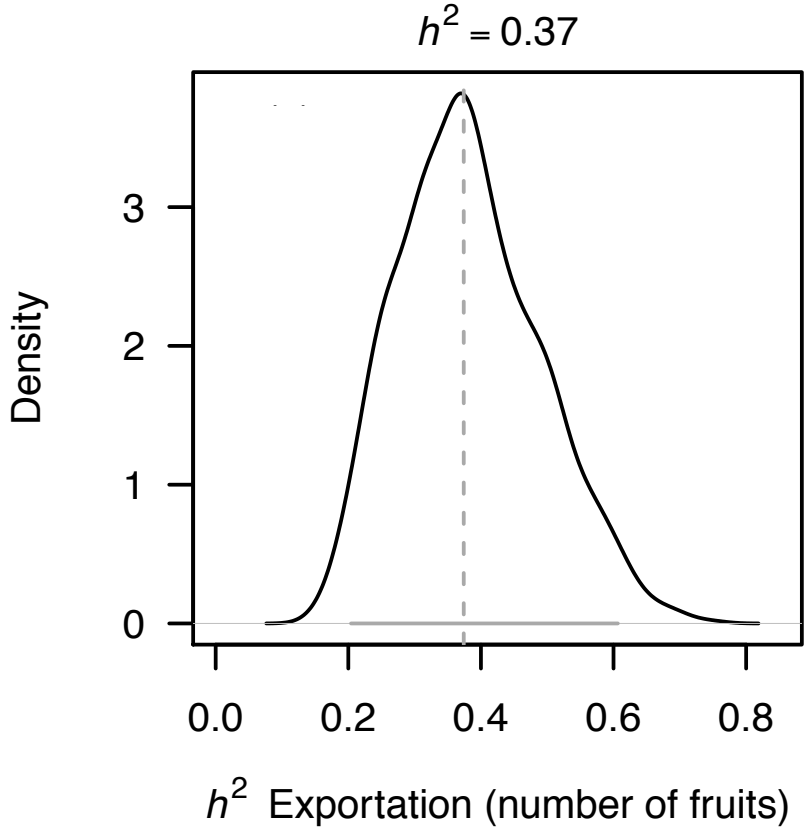

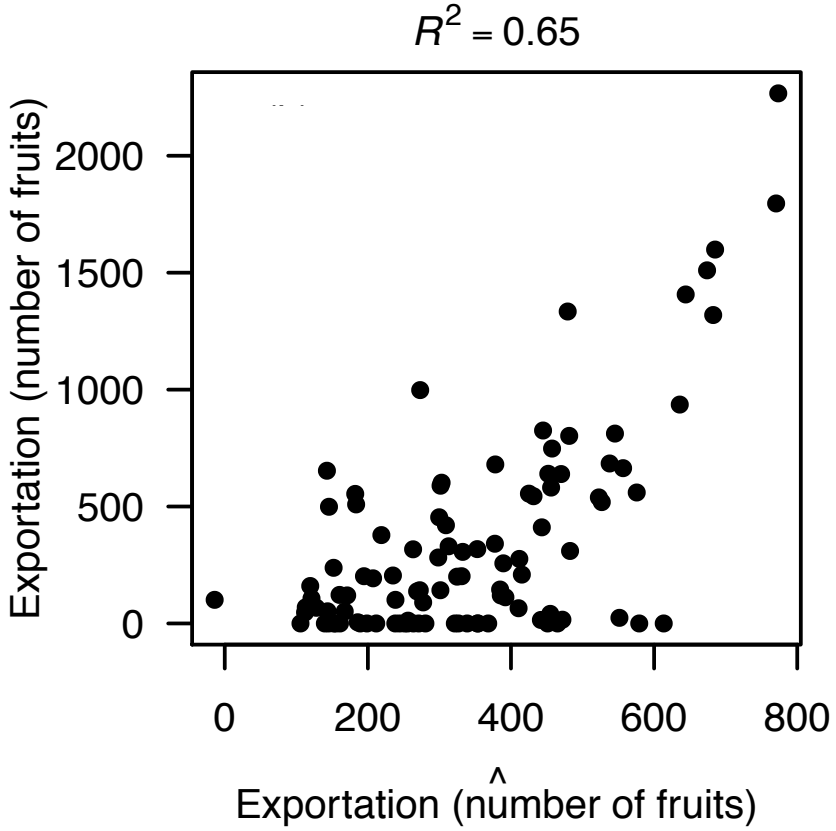

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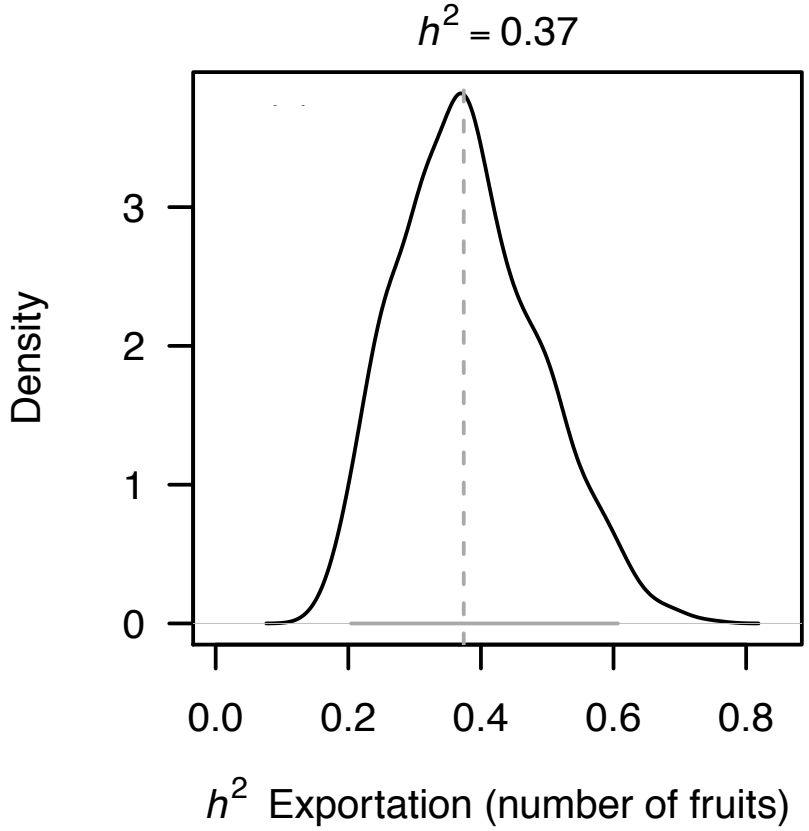

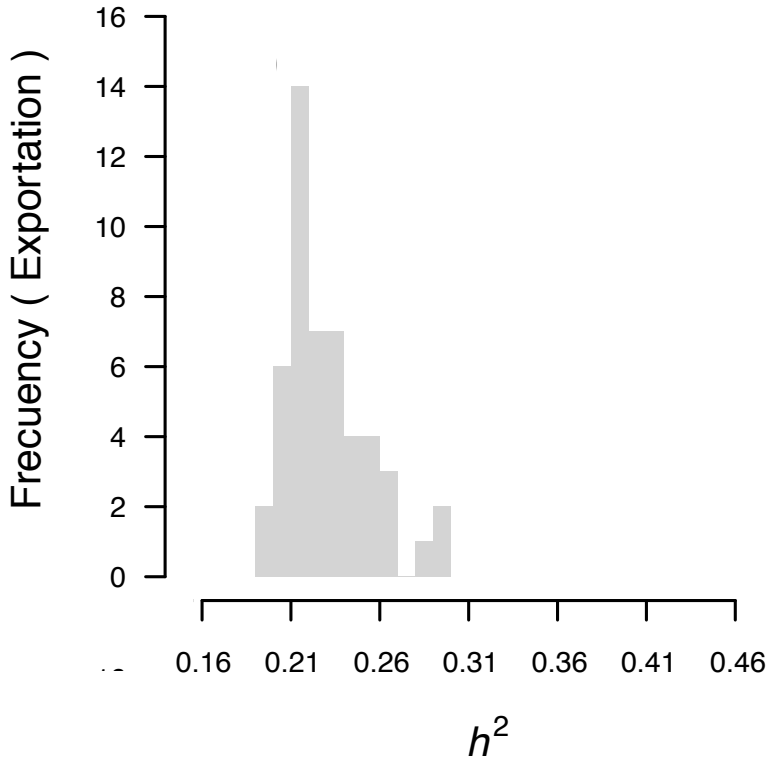

100 randomizations

Rootstock–Mediated Heritabilities (h^2)

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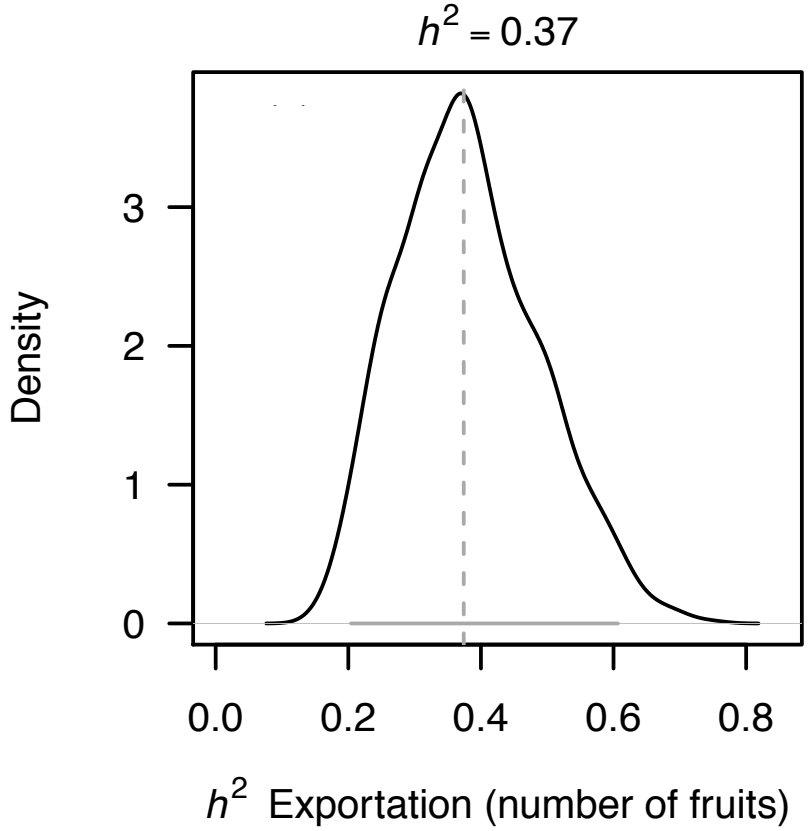

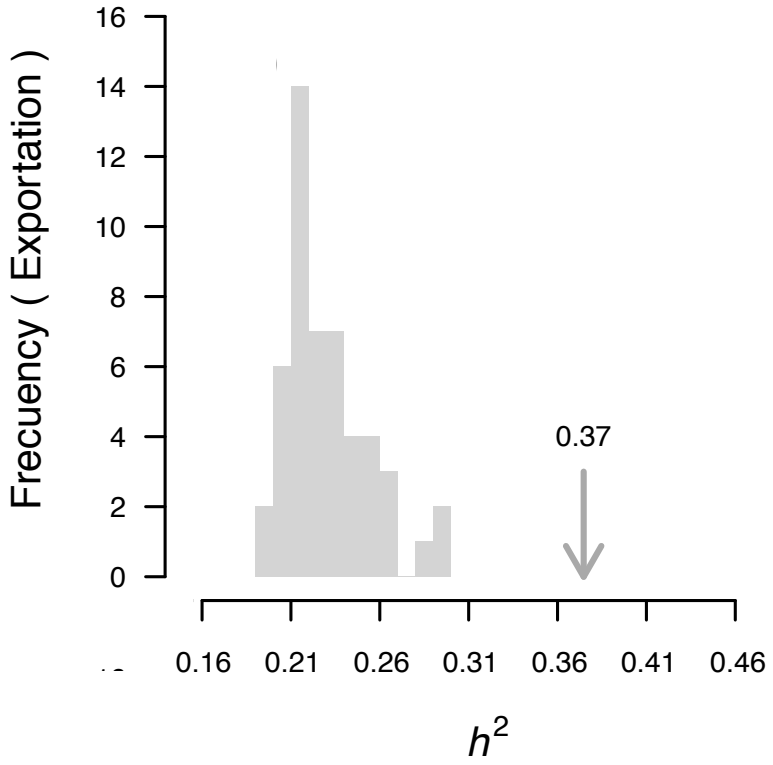

100 randomizations

Rootstock–Mediated Heritabilities (h^2)

ANIMAL MODEL: 13 SSRs + 20 TRAITS

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Estimates of rootstock–mediated heritabilities (h^2) were significant for 5 of the 20 measured traits and ranged from **0.32 to 0.46 h^2** with model fits (R^2) ranging from **0.58 to 0.74** across plantations.

Rootstock–Mediated Heritabilities (h^2)

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Trait type	Trait	SSRs	
		h^2	r^2
Morphological	**Trunk height**	**0.38**	0.64

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Morphological	**Trunk height**	**0.38**	0.64
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Trait type	Trait	SSRs	
		h^2	r^2
Morphological	**Trunk height**	**0.38**	0.64
Eco-physiological	**Total number of fruits**	**0.46**	0.74
Harvest (number of fruits)	**Damage by low weight**	**0.36**	0.64
	Damage by thrips	**0.35**	0.60
	Exportation quality	0.33	0.58

Rootstock–Mediated Heritabilities (h^2)

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Estimates of rootstock–mediated heritabilities (h^2) were significant for 5 of the 20 measured traits and ranged from **0.32 to 0.46 h^2** with model fits (R^2) ranging from **0.58 to 0.74** across plantations.

Trait type	Trait	SSRs		Phenotype		Genetic	
		h^2	r^2	h^2	r^2	h^2	r^2
Morphological	**Trunk height**	**0.38**	0.64	0.36	0.64	0.37	0.64
Eco-physiological	**Total number of fruits**	**0.46**	0.74	0.44	0.73	0.45	0.73
Harvest (number of fruits)	**Damage by low weight**	**0.36**	0.64	0.33	0.62	0.35	0.64
	Damage by thrips	**0.35**	0.60	0.34	0.62	0.34	0.60
	Exportation quality	0.33	0.58	**0.37**	0.65	0.32	0.58

Inheritance of Rootstock Effects in Avocado

CONCLUSIONS

- We identified significant rootstock effects for various harvest and quality traits (*i.e.* **total number of fruits, number of fruits with low weight, number of fruits damaged by thrips, and number of fruits with exportation quality**).

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- These findings suggest the inheritance of rootstock effects on a surprisingly **wide spectrum** of 'Hass' avocado traits.

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- **Genotyping-by-sequencing** will enable us understanding the genetic architecture of rootstock-mediated traits.
- This work reinforces the importance of considering the **rootstock-scion interaction** to enhance our understanding of the consequences of grafting and **speed up fruit tree breeding** programs.

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¡Gracias!