WORKSHOP

La coinnovazione in agrumicoltura biologica: processi di rete tra gli attori della filiera agrumicola nel mediterraneo

Nuovi portainnesti e varietà per l'agrumicoltura biologica

Alberto Continella

Uni ct AGRICOLTURA, ALIMENTAZIONE E AMBIENTE

SICILIAE STVDIVM GENERALE 1434 Università di Catania

alberto.continella@unict.it

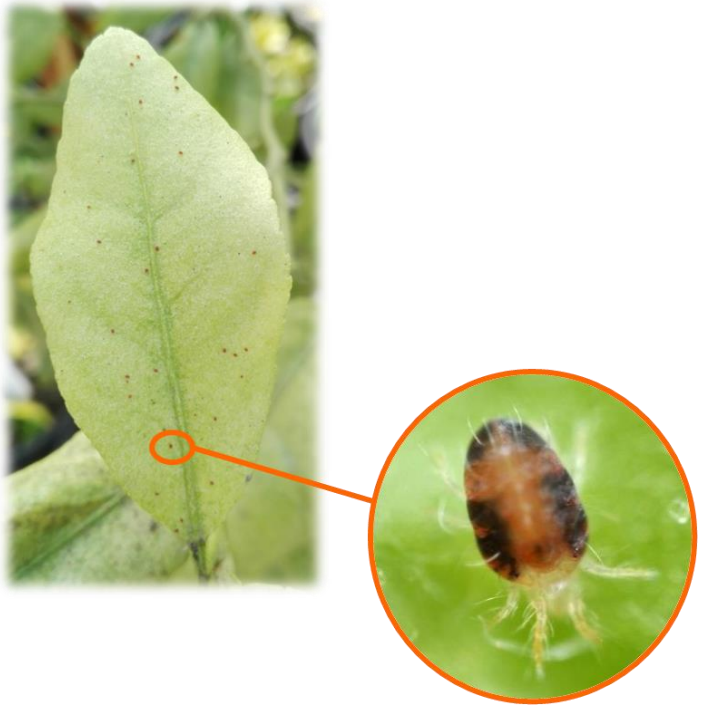
Limone: individuazione di fonti di tolleranza a mal secco e a ragnetto rosso

vs

Mal secco *(Plenodomus tracheiphilus)*

vs

Ragnetto rosso *(Tetranychus urticae)*



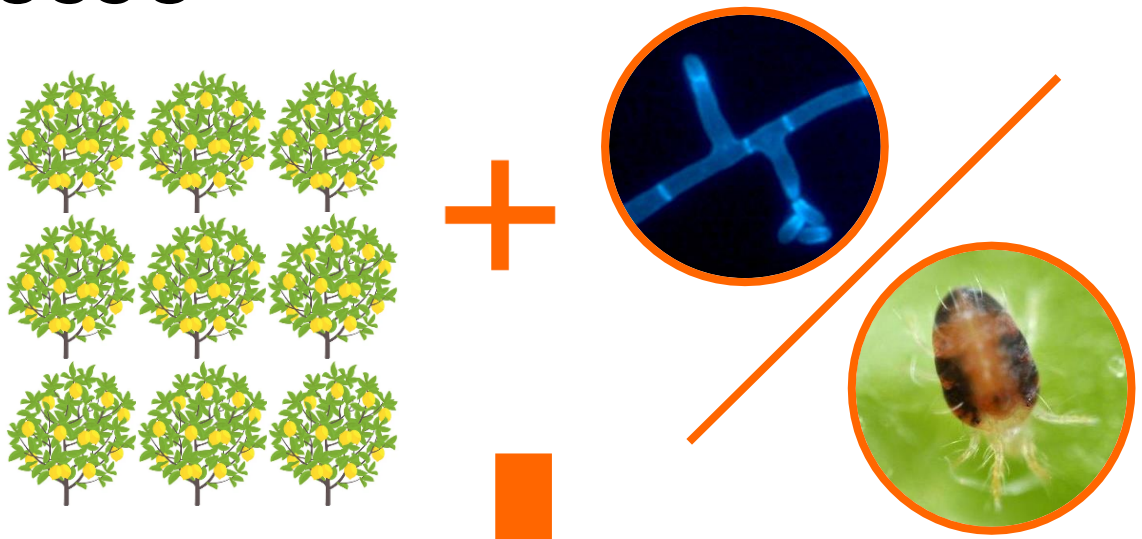
Limone: individuazione di fonti di tolleranza a mal secco e a ragnetto rosso

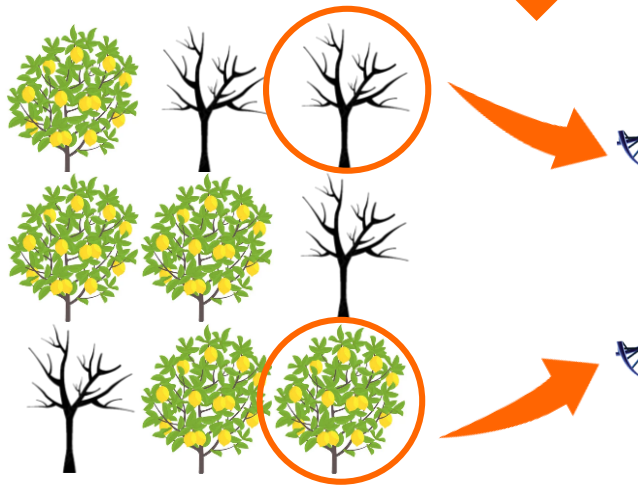
limone 'Interdonato' *x* **limone 'Femminello Siracusano 2Kr'**

tollerante a mal secco

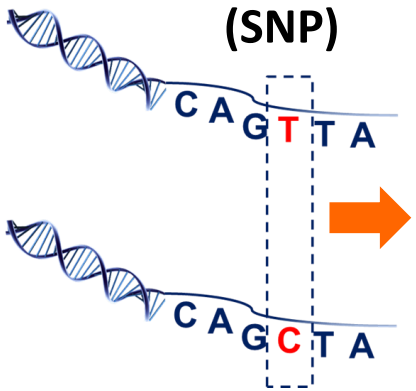
suscettibile a mal secco

(125 individui)





Polimorfismo a singolo nucleotide (SNP)



Selezione Assistita da Marcatori

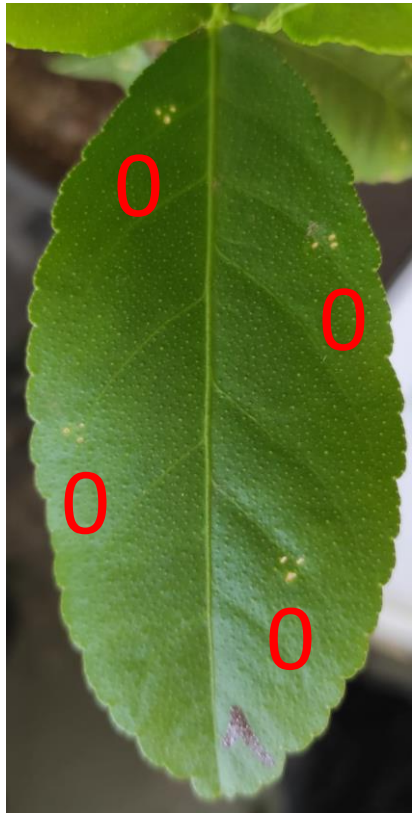
Un nuovo approccio:

- valutazione della **risposta fenotipica**
- **genotipizzazione**
- **analisi QTL**

Fenotipizzazione per l'individuazione di fonti di tolleranza a mal secco e a ragnetto rosso

Mal secco

TOLLERANTE



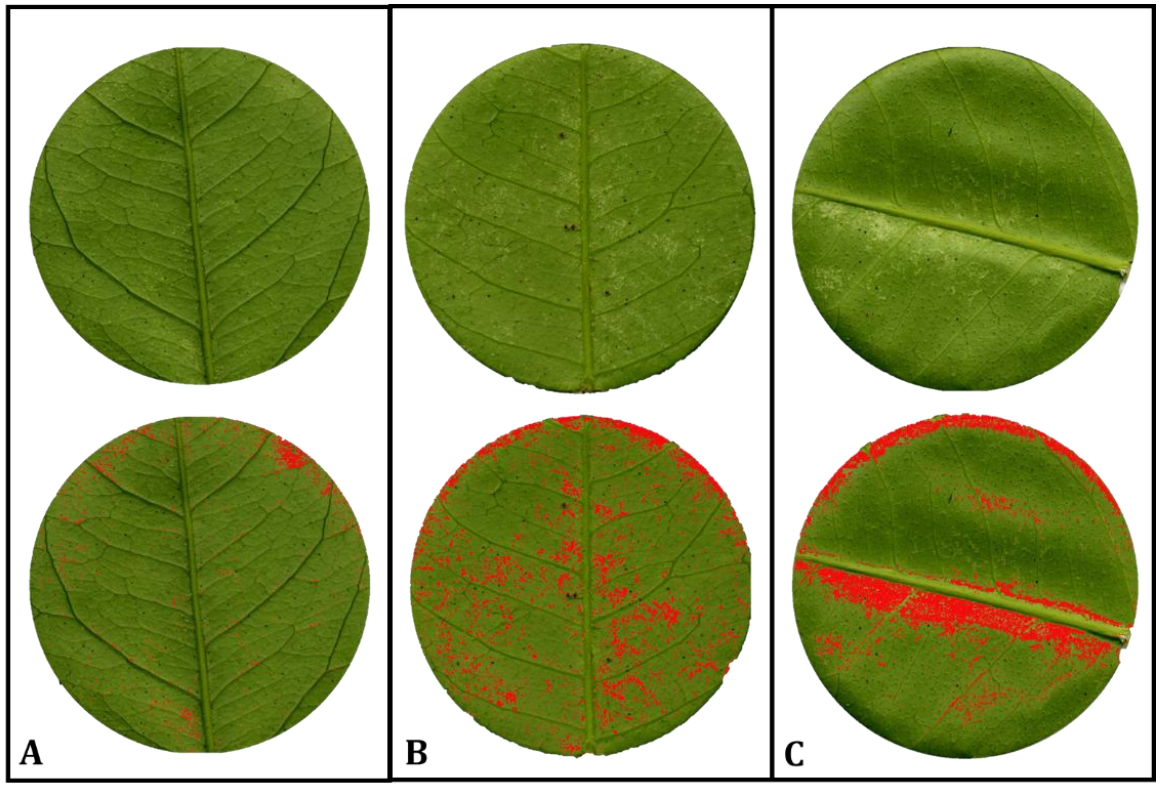
28 gg

VS

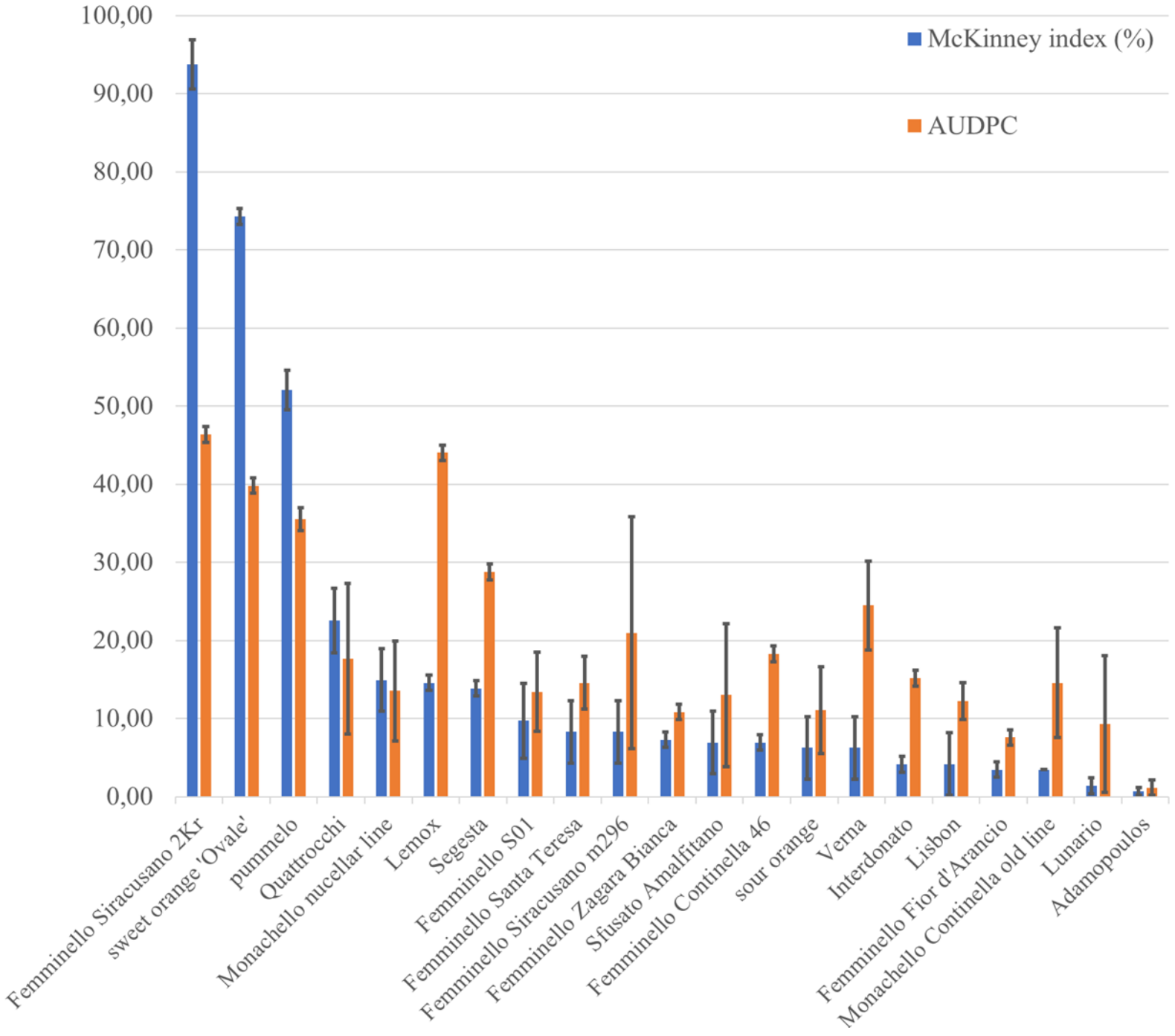
SUSCETTIBILE

28 gg

Ragnetto rosso



Validazione del metodo di fenotipizzazione per mal secco su genotipi di riferimento



Analisi QTL per l'individuazione di fonti di tolleranza a mal secco e a ragnetto rosso

Tree Genetics & Genomes (2021) 17: 46
https://doi.org/10.1007/s11295-021-01528-5

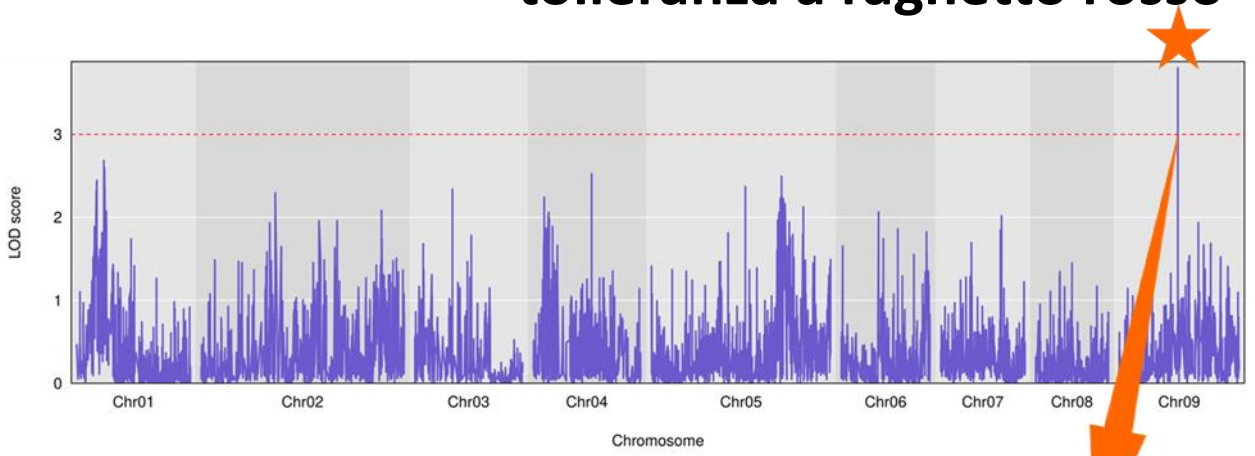
ORIGINAL ARTICLE

Check for updates

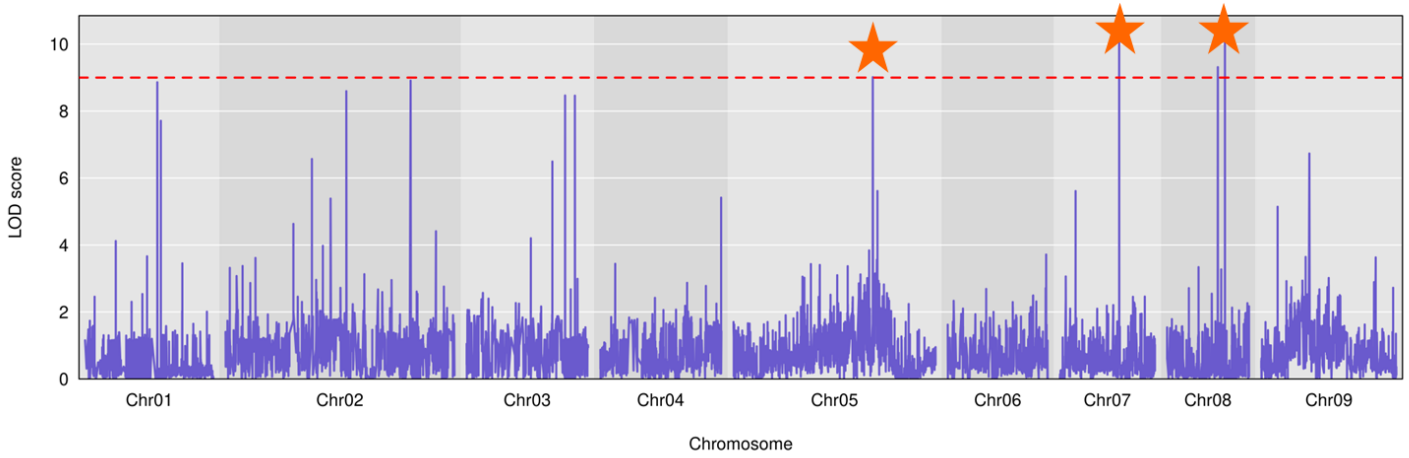
The haplotype-resolved reference genome of lemon (*Citrus limon* L. Burm f.)

Mario Di Guardo[1] · Marco Moretto[2] · Mirko Moser[2] · Chiara Catalano[1] · Michela Troggio[2] · Ziniu Deng[3] · Alessandro Cestaro[2] · Marco Caruso[4] · Gaetano Distefano[1] · Stefano La Malfa[1] · Luca Bianco[2] · Alessandra Gentile[1,3]

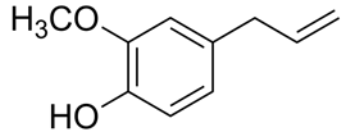
Marcatore per la selezione della tolleranza a ragnetto rosso



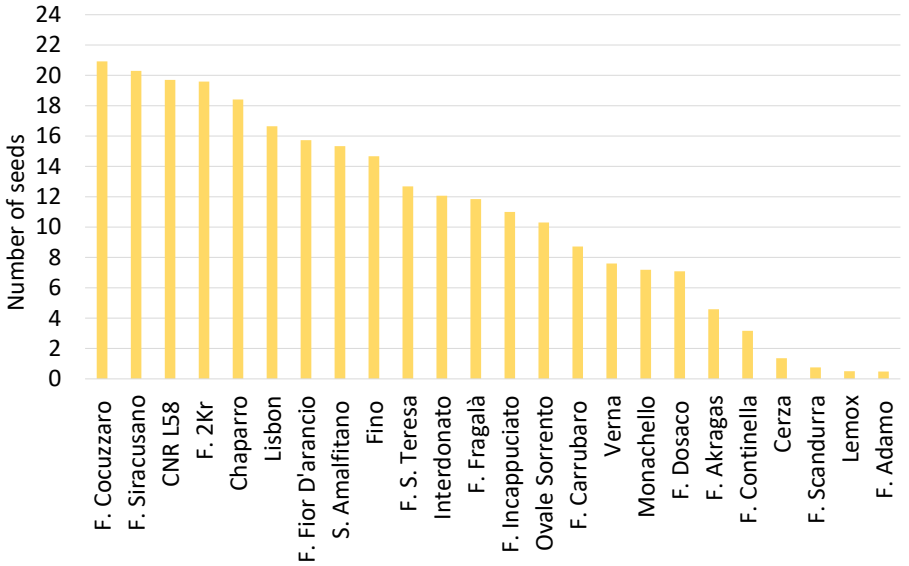
Marcatori per la selezione della tolleranza a mal secco

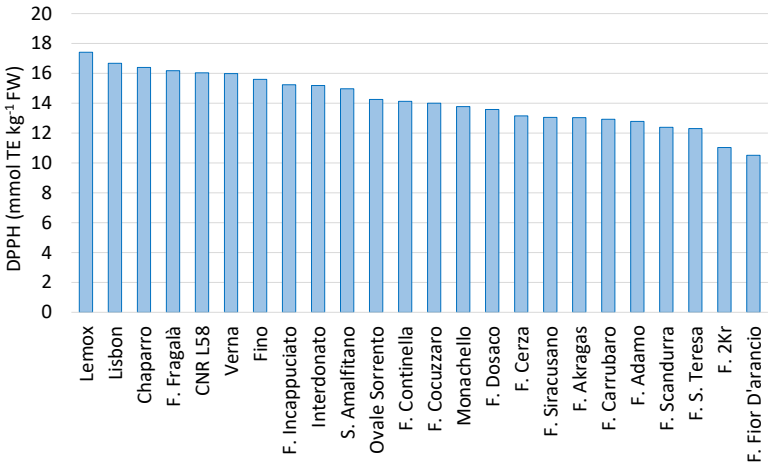


eugenolo sintasi

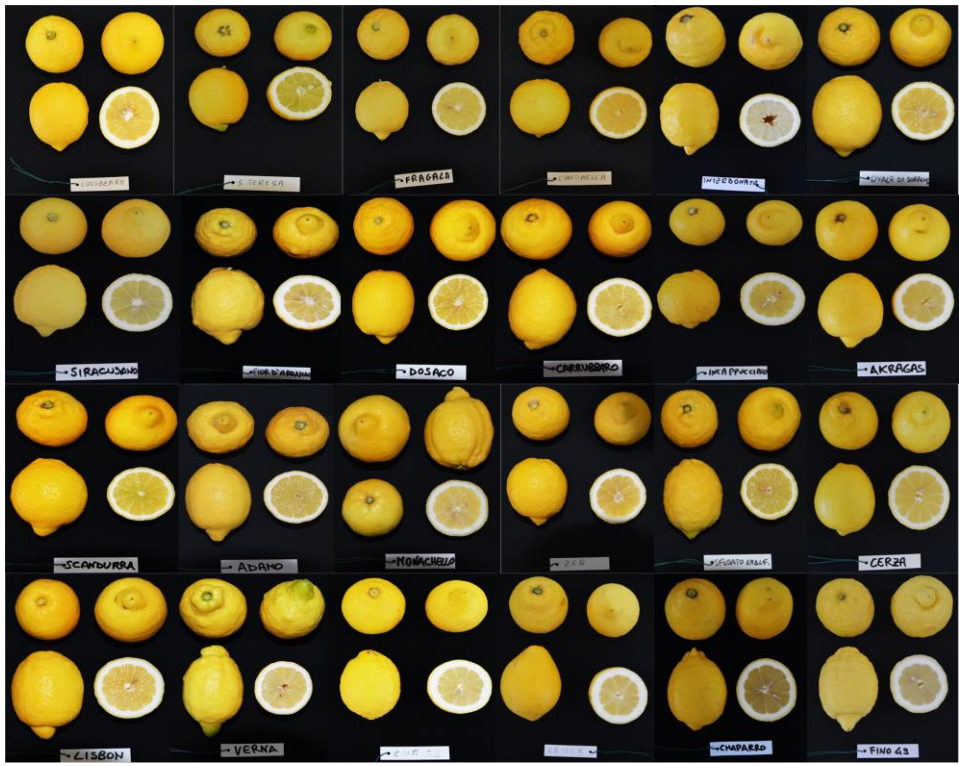


Studio delle caratteristiche pomologiche e dei metaboliti primari e secondari del germoplasma limonicolo siciliano





	Weight (g)		Percentage of juice (%)		TSS (°Brix)		TA (g L^{-1})	
Lemox	224	a	24.3%	m	6.4	op	49.4	i
Interdonato	223	a	37.9%	ab	6.7	op	57.7	fgh
Lisbon	211	ab	31.6%	dfeg	7.6	fgh	67.1	bcd
Fino	204	bc	33.0%	dfeghi	7.4	ghi	64.6	bcdef
Cerza	199	bcd	32.9%	hil	7.0	lmn	59.8	efg
Chaparro	192	cde	32.6%	il	7.9	def	65.2	bcde
F. Fior D'arancio	187	def	30.4%	dfeg	7.9	def	61.7	def
Verna	186	def	30.1%	m	7.1	ilm	54.4	ghi
F. Cocuzzaro	183	ef	32.7%	dfe	8.1	bcd	63.6	cdef
F. Continella	175	fg	33.8%	feghi	6.9	mno	66.5	bcde
F. Dosaco	166	gh	35.1%	dfegh	7.3	il	64.6	bcdef
F. 2Kr	164	gh	28.8%	feghil	7.8	ef	74.6	a
S. Amalfitano	161	ghi	31.6%	lm	8.5	a	62.4	def
Monachello	158	hi	26.8%	abc	6.9	mno	52.3	hi
CNR L58	158	hi	28.3%	cdf	7.3	hil	74.5	a
F. Fragalà	156	hi	35.5%	bcd	7.7	f	67.2	bcd
F. Siracusano	153	hi	29.4%	dfegh	8.4	ab	64.3	bcdef
F. Akragas	152	hi	24.0%	abcd	8.0	cde	60.2	defg
Ovale Sorrento	146	il	35.4%	eghil	8.3	abc	64.3	bcdef
F. Incappuciato	135	lm	30.7%	feghil	6.9	mno	70.8	ab
F. Adamo	134	lm	39.0%	a	7.7	f	70.2	abc
F. Carrubaro	131	m	38.8%	dfeghi	6.7	no	61.0	defg
F. Scandurra	124	m	31.0%	ghil	7.6	fg	66.4	bcde
F. S. Teresa	122	m	34.4%	abcd	8.5	a	71.6	ab



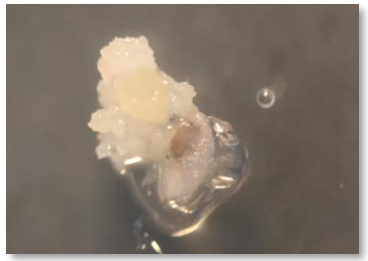
Messa a punto di protocolli di rigenerazione e *genome editing*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 817526

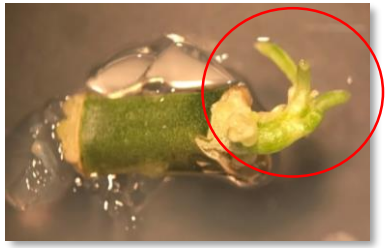


Coltura *in vitro* di diversi espianti di cultivar di arancio dolce, mandarino e limone

Protoplasti

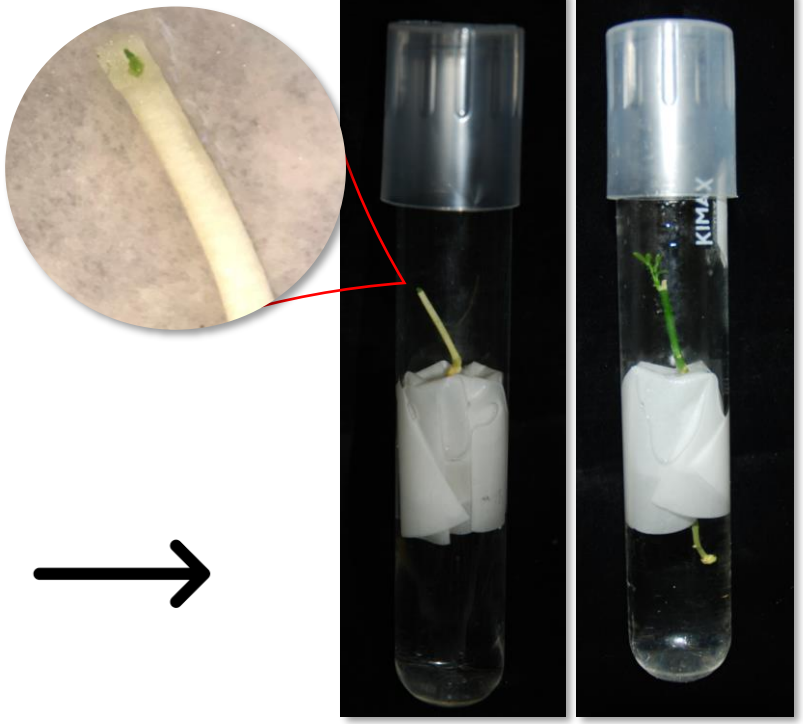


Calli



Internodi

Slice



Microinnesto *in vitro*

Reinnesto in serra

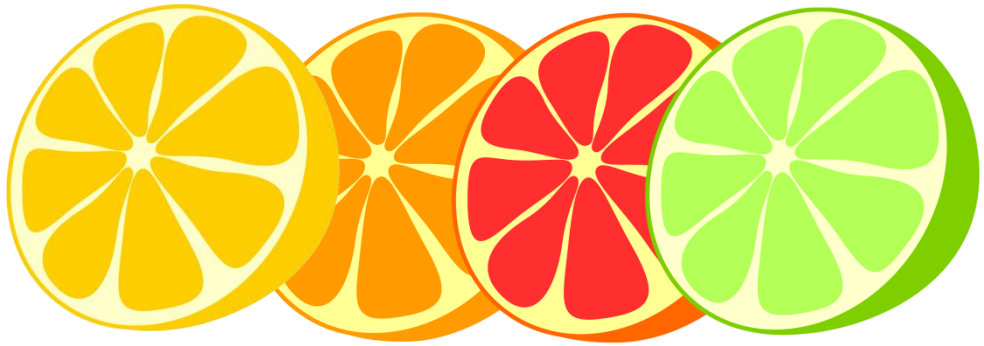
Coordinating Beneficiary: ASAJA MÁLAGA

DURATION: Start: 01/07/2019 **- End:** 30/06/2023

Partner di progetto

Life for Citrus

Development of sustainable control strategies for citric under threat of climate change & preventing entry of HLB in EU



Obiettivi

1. Realizzare un kit per la diagnosi precoce di HLB
2. Valutare portinnesti tolleranti nei confronti dell'agente patogeno e che si adattano alle diverse condizioni pedoclimatiche tipiche del bacino del Mediterraneo
3. Definire pratiche agronomiche ecosostenibili che siano efficaci per controllare la diffusione del vettore
4. Proporre protocolli agronomici ecosostenibili e replicabili al fine di prevenire la diffusione della malattia
5. Promuovere la cooperazione internazionale e coinvolgere tutti gli *stakeholder* del mondo agrumicolo

Kit di identificazione *in situ*

- Identificazione molecolare *in situ*
- Tempo di analisi: 35 minuti
- Non richiede purificazione di acidi nucleici
- Possibile eseguire sia sulla pianta che sull'insetto vettore
- Non richiede un equipaggiamento specializzato
- Sensibilità diagnostica equiparabile a Real Time PCR

HortScience 57(1):56–64. 2022. https://doi.org/10.21273/HORTSCI16206-21

Different Sweet Orange–Rootstock Combinations Infected by *Candidatus* Liberibacter asiaticus under Greenhouse Conditions: Effects on the Roots

Shahrzad Bodaghi, Gabriel Pugina, and Bo Meyering
University of Florida/Institute of Food and Agricultural Sciences, Southwest Florida Research and Education Center, Immokalee, FL 34142

Kim D. Bowman
U.S. Horticultural Research Laboratory, U.S. Department of Agriculture, Agricultural Research Service, Fort Pierce, FL 34945

Ute Albrecht
University of Florida/Institute of Food and Agricultural Sciences, Southwest Florida Research and Education Center, Immokalee, FL 34142

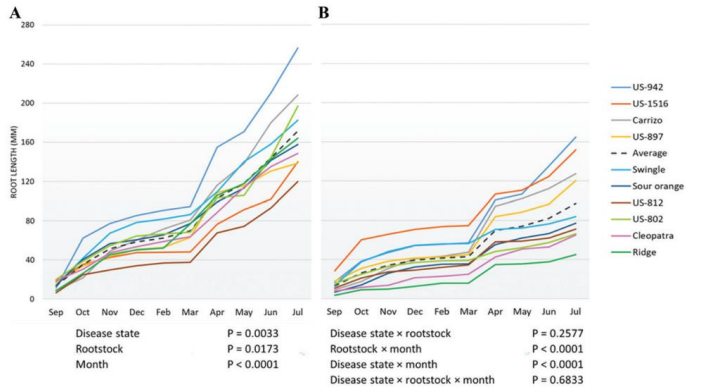


Fig. 1. Root length of (**A**) healthy and (**B**) infected 'Valencia' trees grafted on different rootstocks measured monthly after transplant (12–21 mai). Error bars are not shown for clarity.

HortScience 57(1):144–153. 2022. https://doi.org/10.21273/HORTSCI16205-21

Different Sweet Orange–Rootstock Combinations Infected by *Candidatus* Liberibacter asiaticus under Greenhouse Conditions: Effects on the Scion

Shahrzad Bodaghi and Bo Meyering
University of Florida/Institute of Food and Agricultural Sciences, Southwest Florida Research and Education Center, Immokalee, FL 34142

Kim D. Bowman
U.S. Horticultural Research Laboratory, U.S. Department of Agriculture, Agricultural Research Service, Fort Pierce, FL 34945

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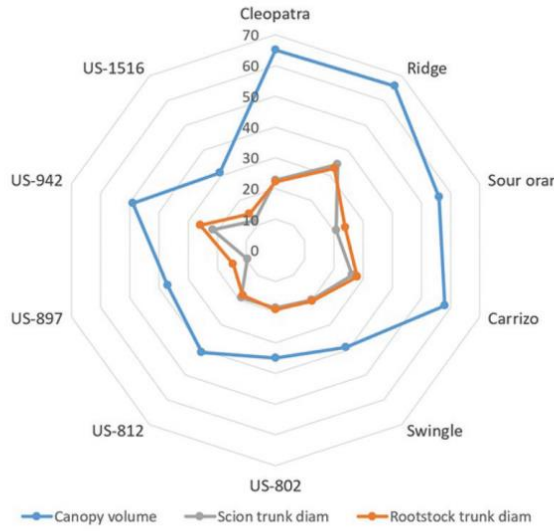


Fig. 1. Reductions (%) in canopy volume, and scion and rootstock trunk diameters of 'Valencia' trees grafted on different rootstocks 21 months after *Candidatus* Liberibacter asiaticus (CLas) inoculation.

HortScience 56(2):244–253. 2021. https://doi.org/10.21273/HORTSCI15550-20

Field Performance of 'Hamlin' Orange Trees Grown on Various Rootstocks in Huanglongbing-endemic Conditions

Sudip Kunwar
Southwest Florida Research and Education Center, University of Florida, Institute of Food and Agricultural Sciences, Immokalee, FL 34142

Jude Grosser, Fred G. Gmitter Jr., and William S. Castle
Citrus Research and Education Center, University of Florida, Institute of Food and Agricultural Sciences, Lake Alfred, FL 33850

Ute Albrecht
Southwest Florida Research and Education Center, University of Florida, Institute of Food and Agricultural Sciences, Immokalee, FL 34142

Table 4. Fruit yield of 'Hamlin' orange trees on different rootstocks.

	Trial 1 (Basinger)		Trial 2 (Lake Wales)		
Rootstock	2018–19 (kg/tree)	2019–20 (kg/tree)	2018–19 (kg/tree)	2019–20 (kg/tree)	Avg cumulative (kg/tree)
ES-1	4.4 a	20.2 a	18.0 ab	16.3 a-e	29.5 a
UFR-5	6.7 a	17.4 a	20.2 a	11.8 a-h	28.0 ab
C-54	4.4 a	16.0 a	17.2 a-c	18.3 ab	28.0 ab
X-639	3.7 a	17.6 a	14.4 a-d	19.9 a	27.8 ab
C-57	7.3 a	14.7 a	13.4 a-d	17.7 a-c	26.6 a-c
ES-4	7.7 a	14.5 a	17.1 a-c	13.7 a-f	26.5 a-c
US-897	8.5 a	13.8 a	13.6 a-d	13.3 a-g	24.6 a-d
Swingle	7.2 a	15.6 a	13.9 a-d	12.1 a-h	24.4 a-e
ES-7	4.5 a	16.7 a	10.3 a-d	17.1 a-d	24.3 a-e
ES-6	5.1 a	18.9 a	11.4 a-d	11.9 a-h	23.6 a-e
ES-5	2.8 a	17.1 a	14.4 a-d	12.4 a-h	23.4 a-e
Green-7	7.3 a	19.9 a	10.5 a-d	9.0 d-h	23.2 a-e
C-22	6.0 a	13.3 a	13.2 a-d	13.7 a-f	23.1 a-e
Orange-14	7.6 a	13.2 a	12.0 a-d	13.2 a-h	22.9 a-e
ES-3	4.0 a	18.7 a	11.8 a-d	10.4 b-h	22.5 a-e
Amb+Czo	6.1 a	18.2 a	12.5 a-d	7.6 f-h	22.2 a-e
6058+2071-02-2	6.3 a	18.3 a	9.3 b-d	10.3 b-h	22.1 a-e
UFR-4	4.9 a	17.4 a	11.7 a-d	9.6 c-h	21.8 a-e
C-146	4.9 a	11.4 a	13.5 a-d	13.8 a-f	21.8 a-e
White-1	5.0 a	15.2 a	10.8 a-d	11.2 b-h	21.1 a-e
UFR-1	4.8 a	16.3 a	9.2 b-d	9.6 c-h	20.0 a-e
Wgft+50-7	6.1 a	18.2 a	6.0 d	9.5 c-h	19.9 a-e
UFR-17	4.5 a	15.6 a	10.9 a-d	8.4 e-h	19.7 a-e
UFR-6	6.8 a	13.8 a	10.1 a-d	7.1 f-h	18.9 a-e
UFR-2	6.3 a	16.4 a	7.7 cd	7.3 f-h	18.8 a-e
ES-2	3.9 a	11.2 a	11.1 a-d	10.8 b-h	18.5 a-e
Green-3	4.2 a	12.6 a	8.3 b-d	9.0 d-h	17.0 b-e
Amb+Benton	5.4 a	11.7 a	6.8 d	7.3 f-h	15.6 c-e
Changsha+Benton	6.5 a	10.5 a	9.0 b-d	4.6 h	15.3 c-e
Sorp+Sh-991	4.3 a	14.4 a	4.6 d	4.9 gh	14.1 de
UFR-3	4.9 a	9.6 a	6.2 d	5.7 f-h	13.1 e
Sour orange	7.4 a	13.3 a	—	—	—
F value	1.62*	1.78*	3.79***	6.19***	3.95***

Different letters within columns indicate significant differences according to Tukey's honestly significant difference test. *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

Portinnesti vs. HLB

Action C1: Testing of HLB-tolerant citrus rootstocks

Utilizzo di portinnesti tolleranti

- **Nell'ambito del progetto, nel clima mediterraneo sono stati identificati potenziali portinnesti tolleranti all'HLB**
- **Studio della risposta dei nuovi portinnesti alle diverse condizioni pedoclimatiche in combinazione con cultivar locali**

Experimental Field of University of Catania

x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	1	1	14	14	12	12	18	18	9	9	8	8	3	3
x	5	5	2	2	15	15	10	10	17	17	13	13	18	18
x	7	7	16	16	17	17	1	1	15	15	11	11	9	9
x	10	10	3	3	4	4	8	8	12	12	14	14	17	17
x	8	8	6	6	11	11	14	14	7	7	2	2	10	10
x	13	13	5	5	9	9	15	15	16	16	3	3	4	4
x	15	15	7	7	14	14	12	12	2	2	1	1	7	7
x	12	12	11	11	3	3	13	13	5	5	6	6	16	16
x	4	4	1	1	16	16	2	2	8	8	10	10	14	14
x	6	6	17	17	5	5	6	6	4	4	18	18	11	11
x	9	9	10	10	7	7	4	4	13	13	12	12	8	8
x	3	3	15	15	6	6	17	17	18	18	16	16	2	2
x	11	11	13	13	18	18	9	9	1	1	5	5		
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

in red = missing plants
x = edge plants

Design: Randomized blocks
Density : 4 blocks in m 5x4
Planting: 2021
Scion: Tarocco

1. citrange carrizo
2. Forner Alcaide 5
3. US942
4. US 897
5. C22 Bitters
6. X639
7. Forner Alcaide 517
8. Flying dragon
9. Citrus macrophylla
10. Citrandarin 4x
11. Citrumelo 4x
12. C54 Carpenter
13. C35 citrange
14. C57 Furr
15 FA 74
16 FA5115
17 FA 5128
18 citrumelo Swingle

Carrizo
Forner-Alcaide nº5
US942 (LD1)
US897 (LD2)
C22 Bitters (LD4)
X639 (LD5)
Forner-Alcaide nº517
Flying dragon
FA 74
FA 5115
FA 5128
Citrus macrophylla
C54 Carpenter
C57 Furr
C35
Citrandarina 4X
Citrumelo 4X
Florag alotetraploide
Poncirus pomeroy (only INRAE)
Macrophylla 288 (only INRAE)
Cleopatra* (only ICIA)
Citrumelo 4x X Volkameriana 4x (only CIRAD)
Volkameriana 4x (only CIRAD)
Citrumelo 44775 Swingle (only VALENCIAGRO)

Azione C3

Valutazione di nuovi portinnesti

Contribuire allo sviluppo delle migliori pratiche di gestione agricola

Consolidare nuovi metodi naturali di controllo dei vettori


T1 Smart biological control


T2 Summer pruning and field hygiene


T3 Irrigation optimization


T4 Smart Inputs


T5 Combination: T1, T2, T3 y T4


T6 Control (using conventional methods)

Action C3 Demonstration in trial areas

Plot #1 - studio dell'effetto di 9 portinnesti sulla varietà arancia rossa Tarocco Sciré

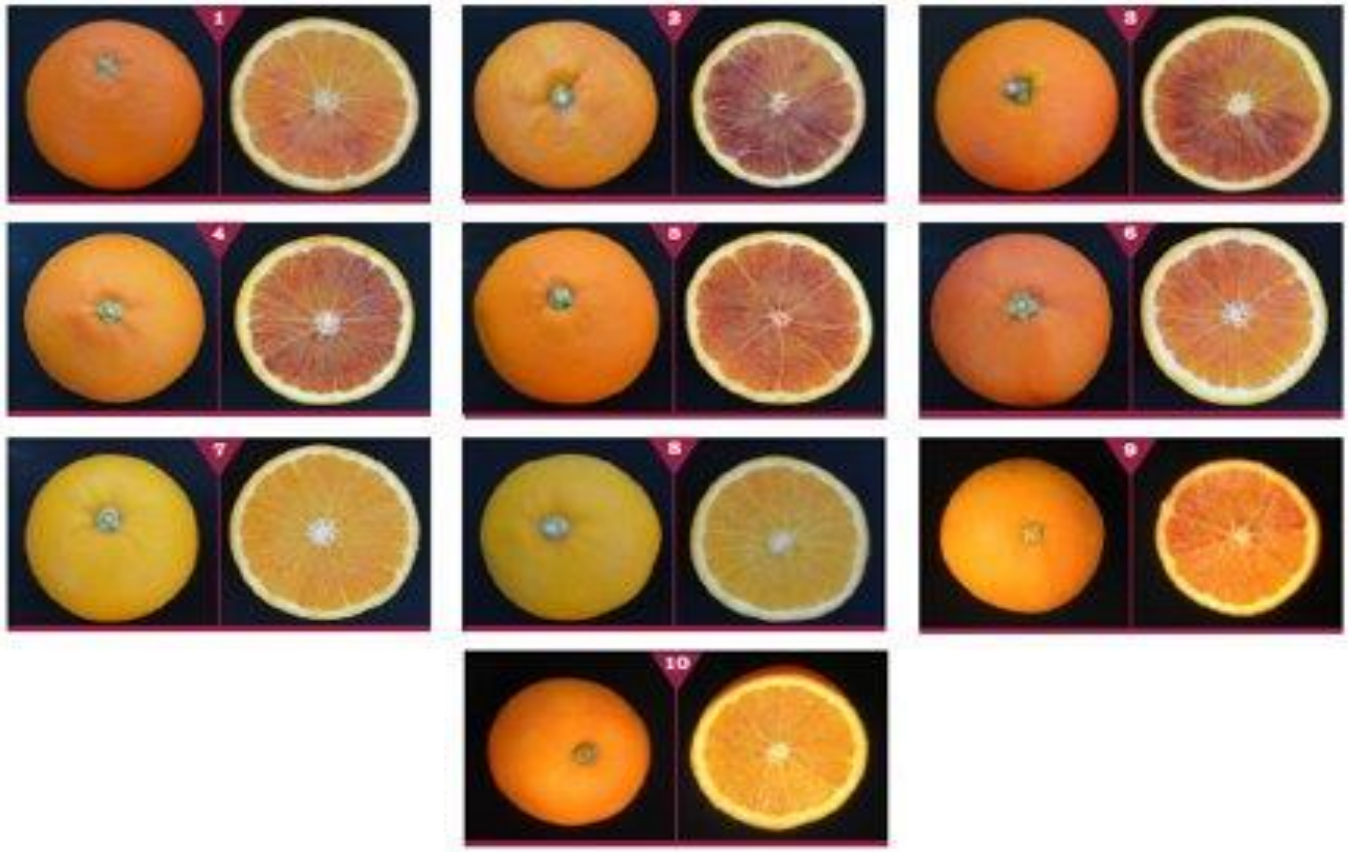
Design delle attività

Plot #2 - effetto della copertura vegetale (cover crops) sullo sviluppo vegeto-produttivo e qualitativo di Sanguinello

Plot #3 – effetto dei biostimolanti sullo sviluppo vegeto-produttivo e qualitativo del Tarocco Ippolito

Plot #4 – analisi della risposta vegetativa del Moro alla potatura verde

Plot #5 – effetto delle micorrize sullo sviluppo vegeto-produttivo e qualitativo del Tarocco Rosso



Rootstock	Origin of genotypes
citrange Troyer and Carrizo	*Citrus sinensis* (L.) Osbeck cv. Washington navel x *Poncirus trifoliata* (L.) Raf.
citrange C35	*C. sinensis* (L.) Osbeck cv. Ruby x *P. trifoliata* (L.) Raf.
citrumelo Swingle	*C. paradisi* (Macfadyen) x *P. trifoliata* (L.) Raf.
Bitters, Carpenter, and Furr	*C. sunki* Hort. ex Tan. x *P. trifoliata* (L.) Raf.
F6P12® and F6P13	*C. latipes* x *P. trifoliata* (L.) Raf.
Severinia	*Severinia buxifolia* (Poir) Tenore

Fruits of Tarocco Sciré cultivar harvested at maturity grafted onto 10 rootstocks. From left to right: citrange Carrizo (1), citrange Troyer (2), C35 (3), Bitters (4), Carpenter (5), Furr (6), citrumelo Swingle (7), *Severinia buxifolia* (8), F6P12 (9), F6P13 (10)

2010

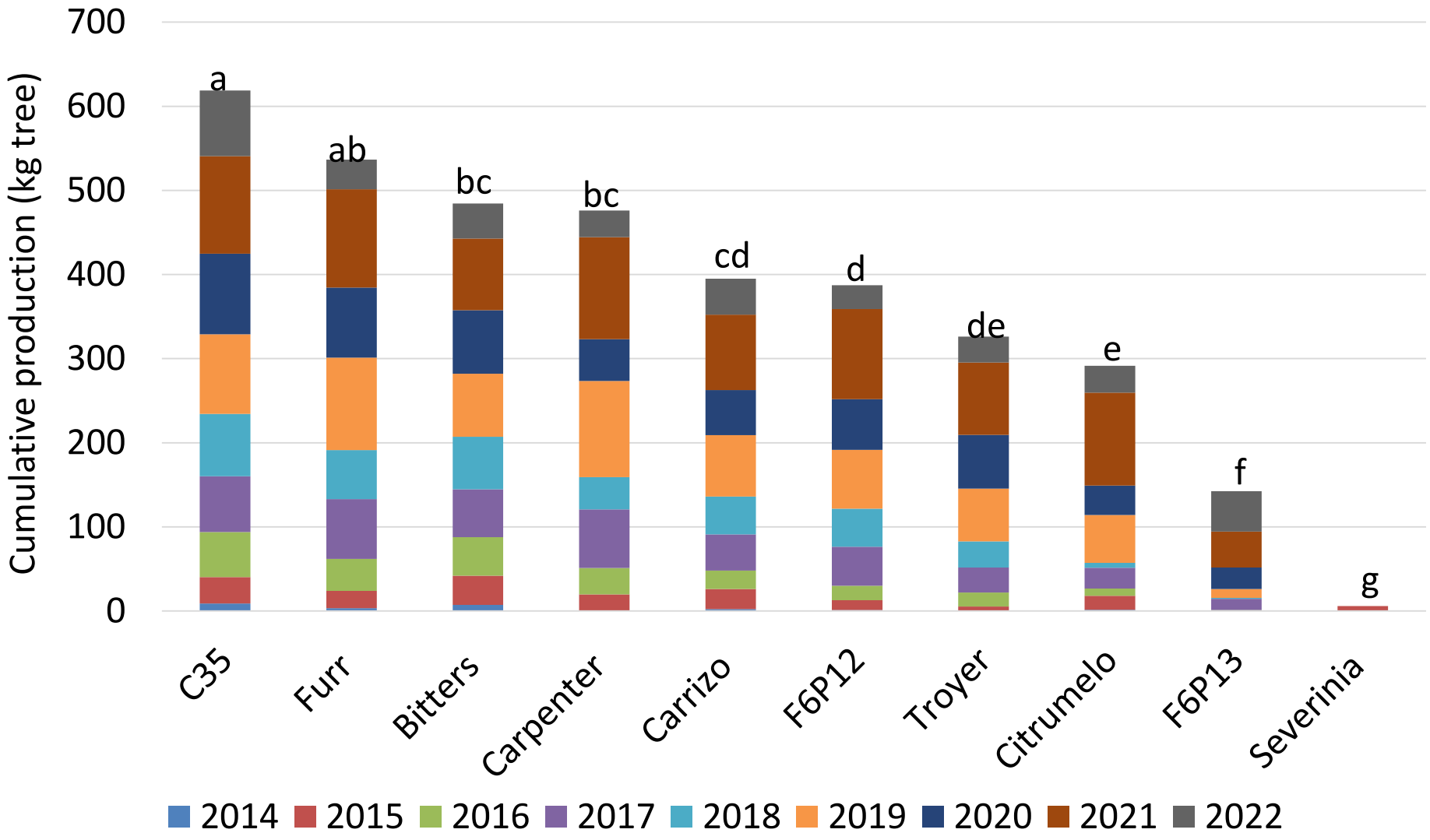
pH: 7.8 Active lime: 1.0% Sandy-loam soil

Bitters (C22)

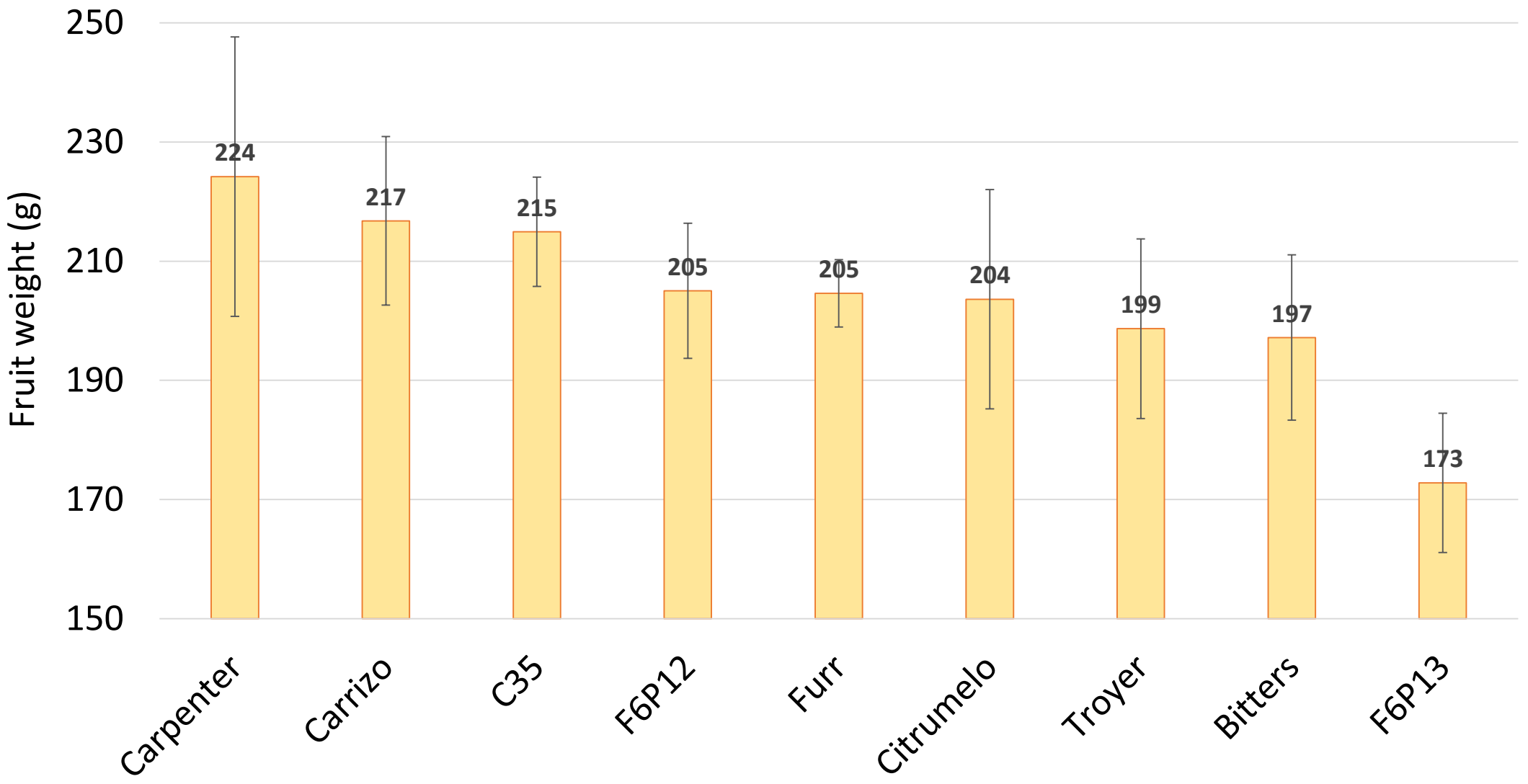
Carpenter (C54)

Furr (C57)

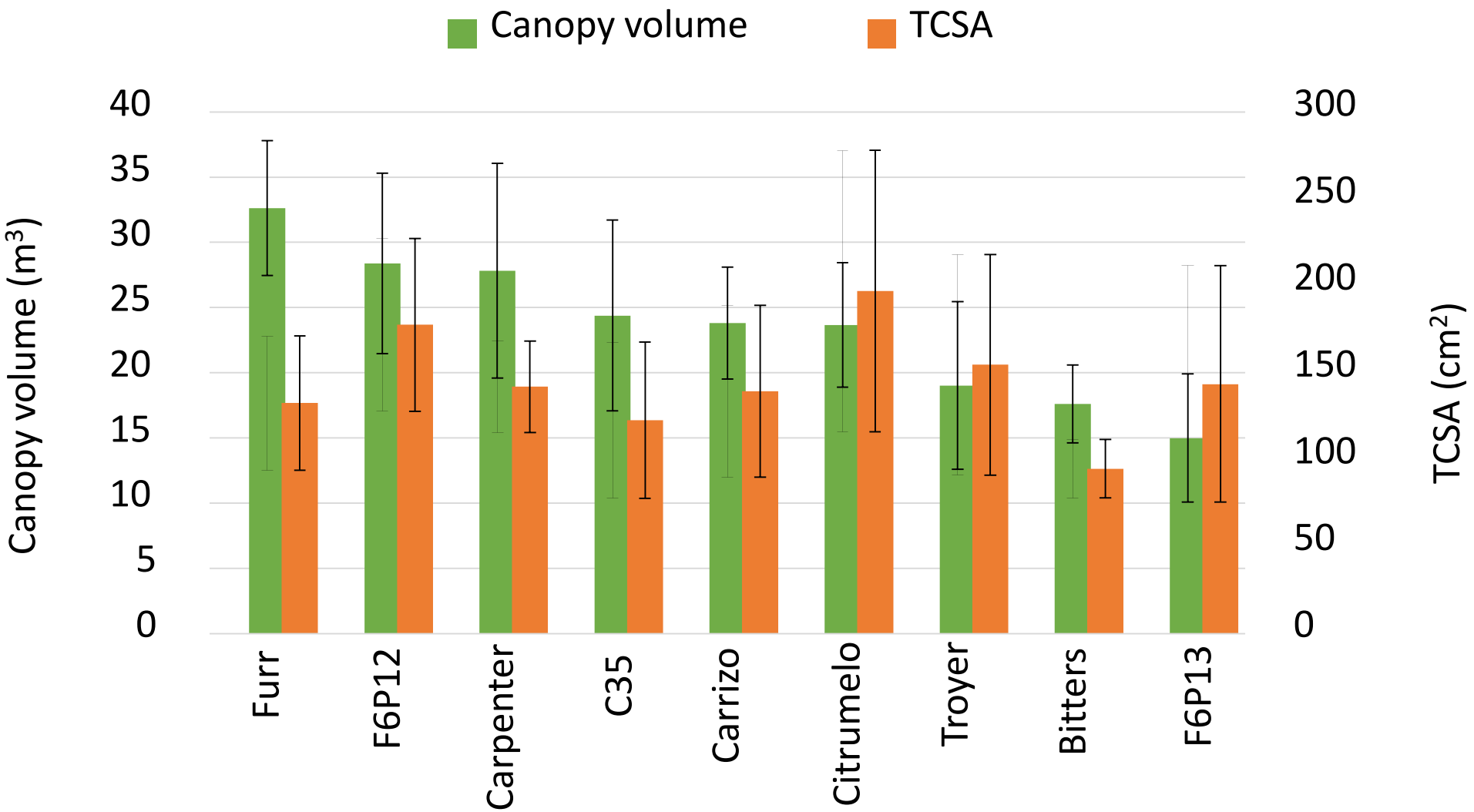
Cumulative yield recorded on Tarocco Scirè blood orange on studied rootstocks for 9 years



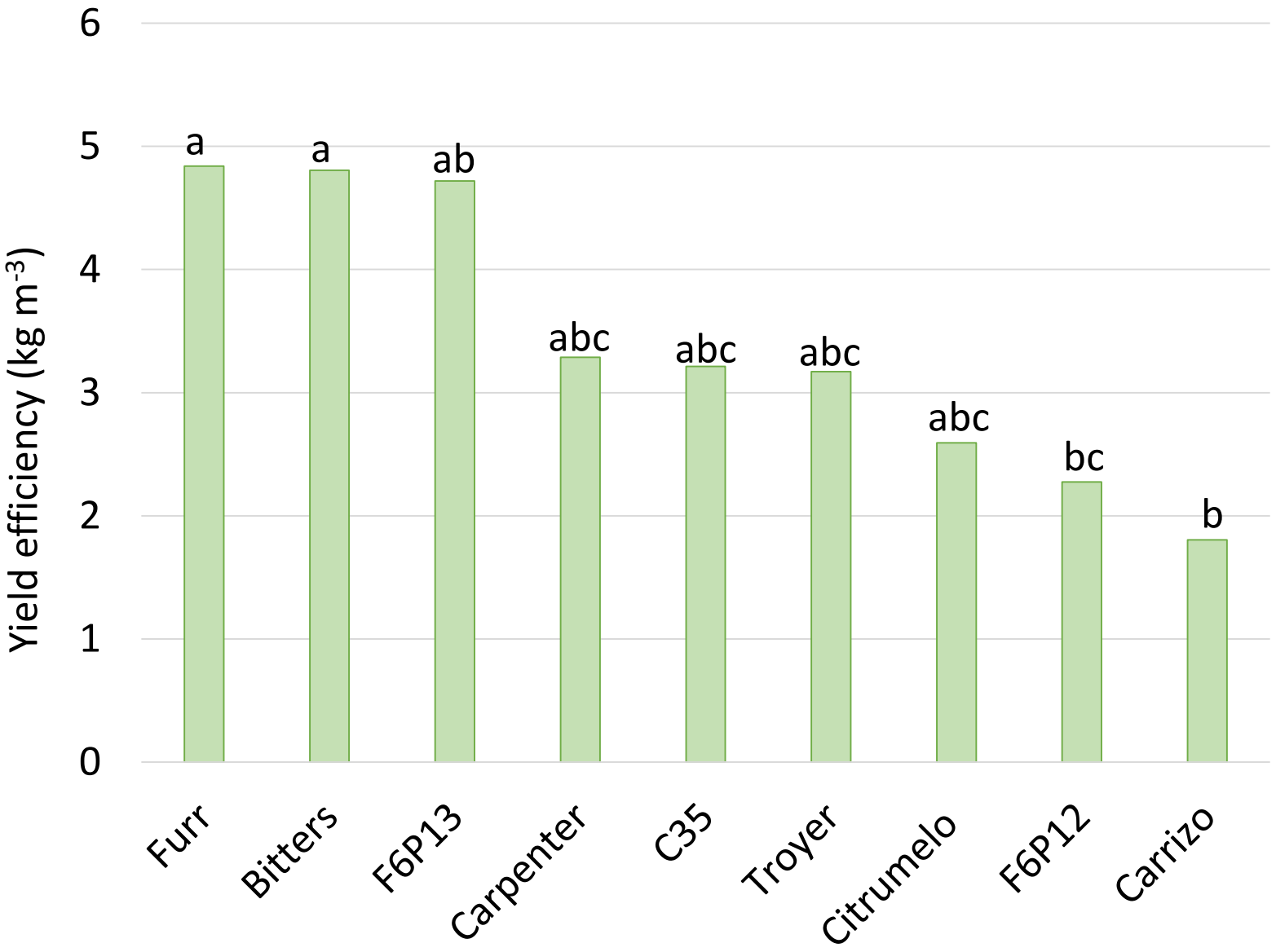
Mean fruit weight of Tarocco Sciré grafted onto studied rootstocks (average of 7 years)



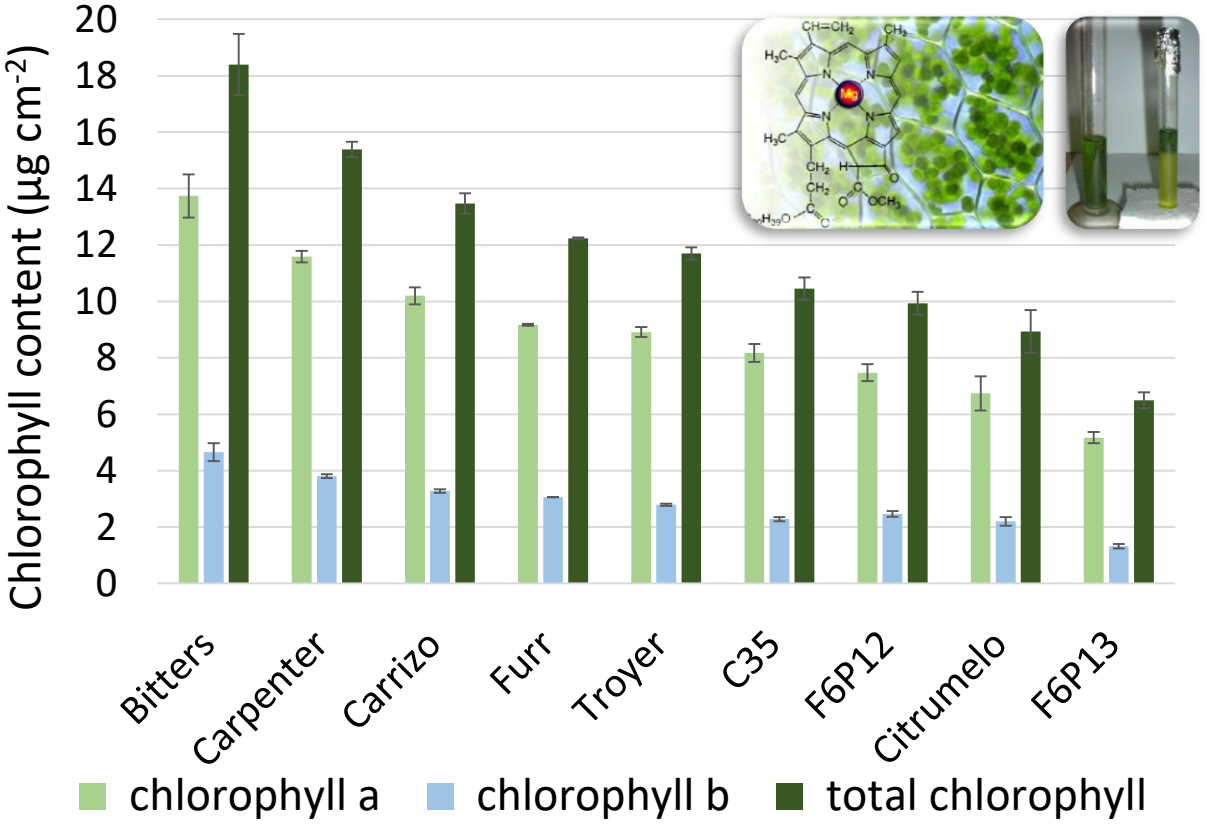
Canopy volume and trunk cross-sectional area (TCSA) of Tarocco Sciré on studied rootstocks in 2019

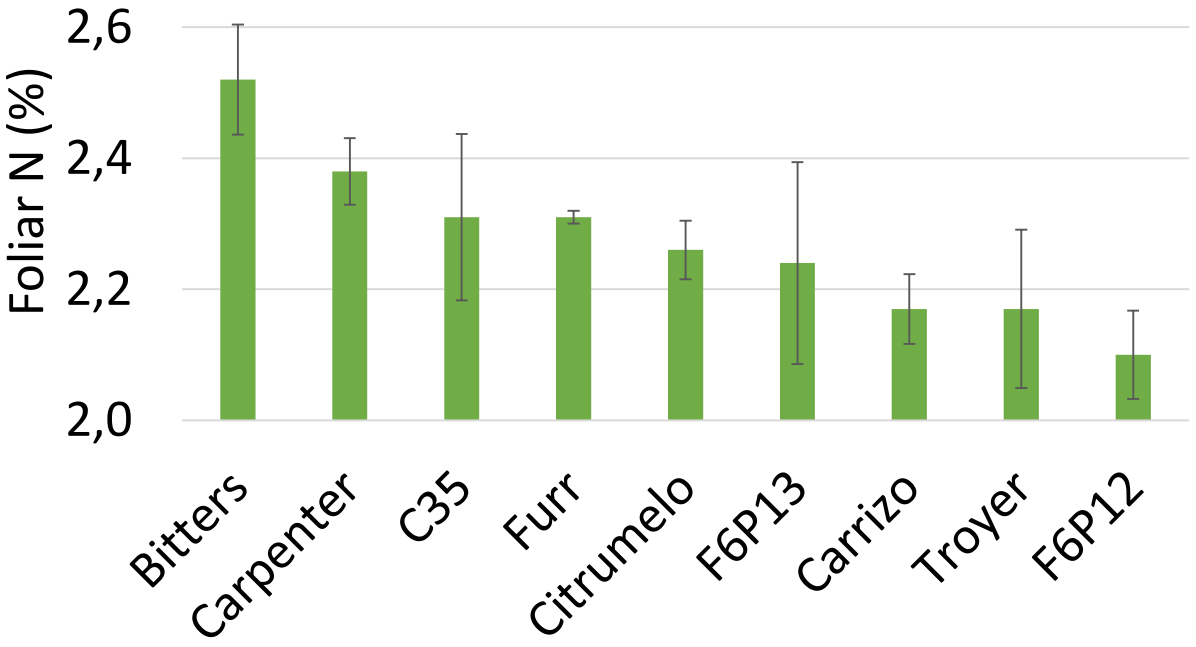


Yield efficiency of Tarocco Scirè on studied rootstocks in 2021/2022



Chlorophyll and nitrogen content in Tarocco Sciré leaves grafted onto studied rootstocks





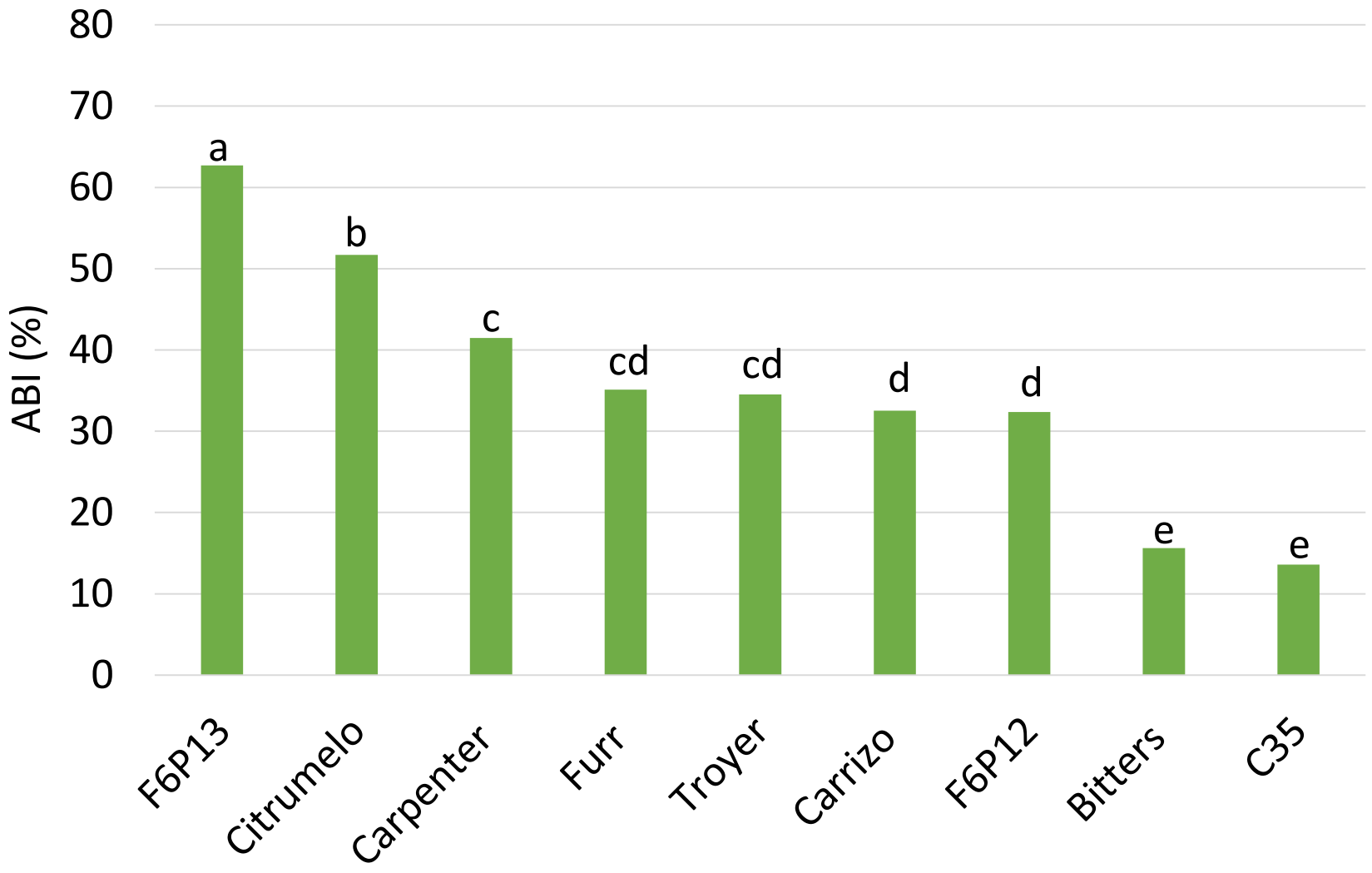
Tarocco Sciré grafted onto Bitters

Bitters

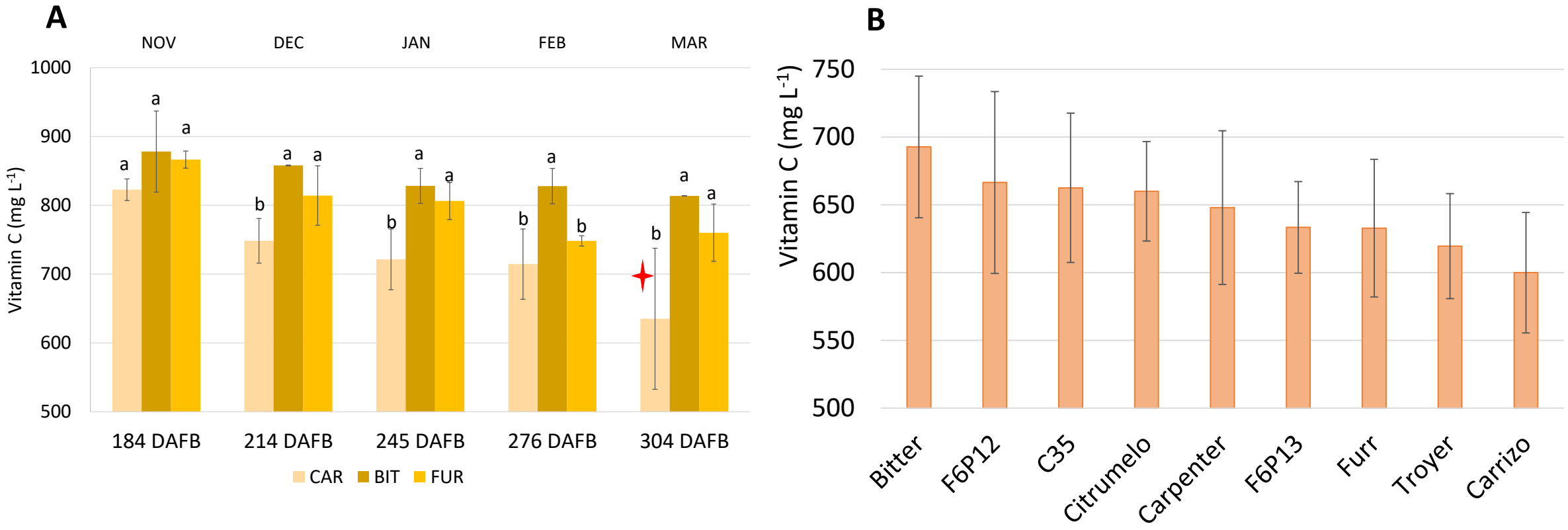
Carrizo

Citrumelo

Alternate-bearing index (ABI) of Tarocco Scirè grafted on studied rootstocks recorded in 5-year (2018-2022)

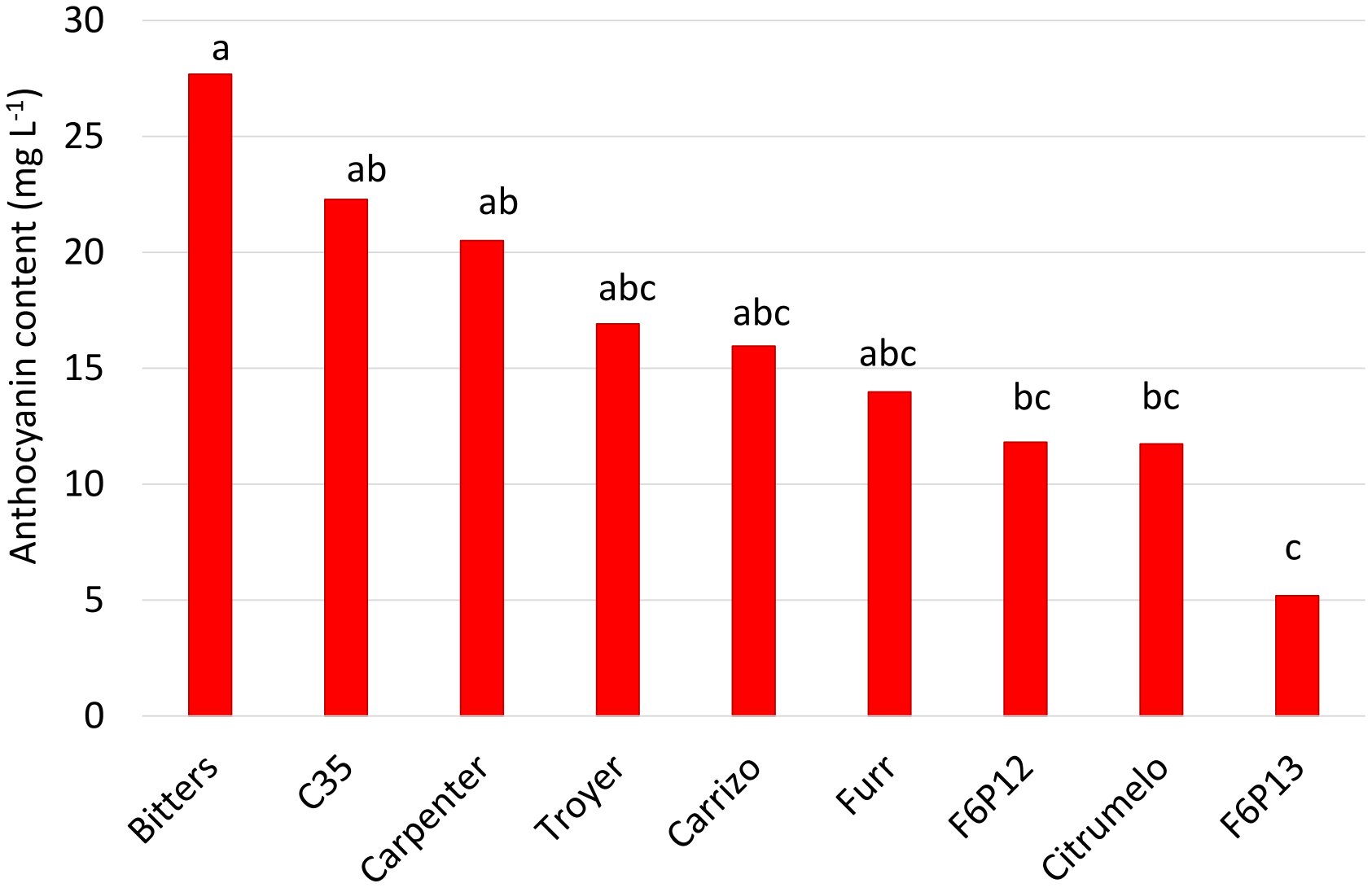


Evolution and average (4 years) of vitamin C content in juice of Tarocco Scirè blood orange grafted on the studied rootstocks



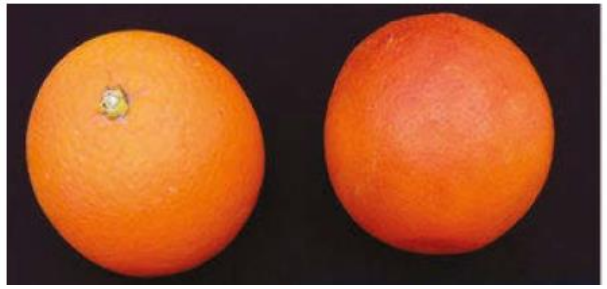
A: Evolution of Vitamin C (mg L^{-1}) in juice of Tarocco Sciré grafted onto Carrizo (CAR), Bitters (BIT) or Furr (FUR) during the different harvest dates (from November to March).
B: content of vitamin C, mean of 4 years.

Anthocyanin content recorded in 2022 on fruit juice of Tarocco Scirè blood orange grafted on the studied rootstocks

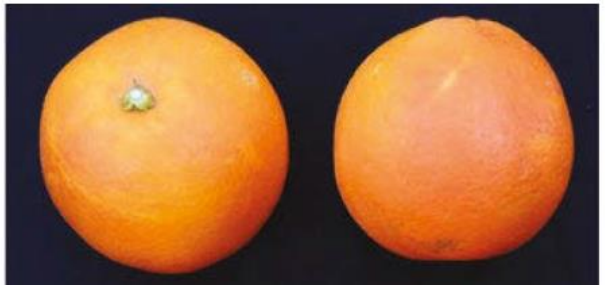


Rootstock influences peel and flesh colour

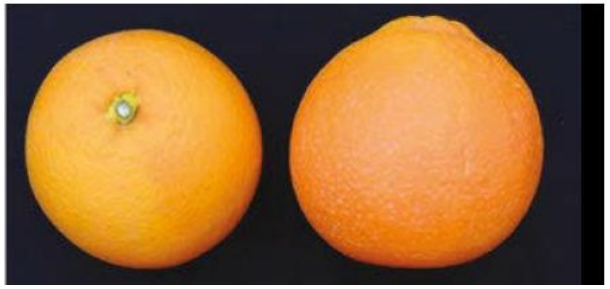
Bitters



C35

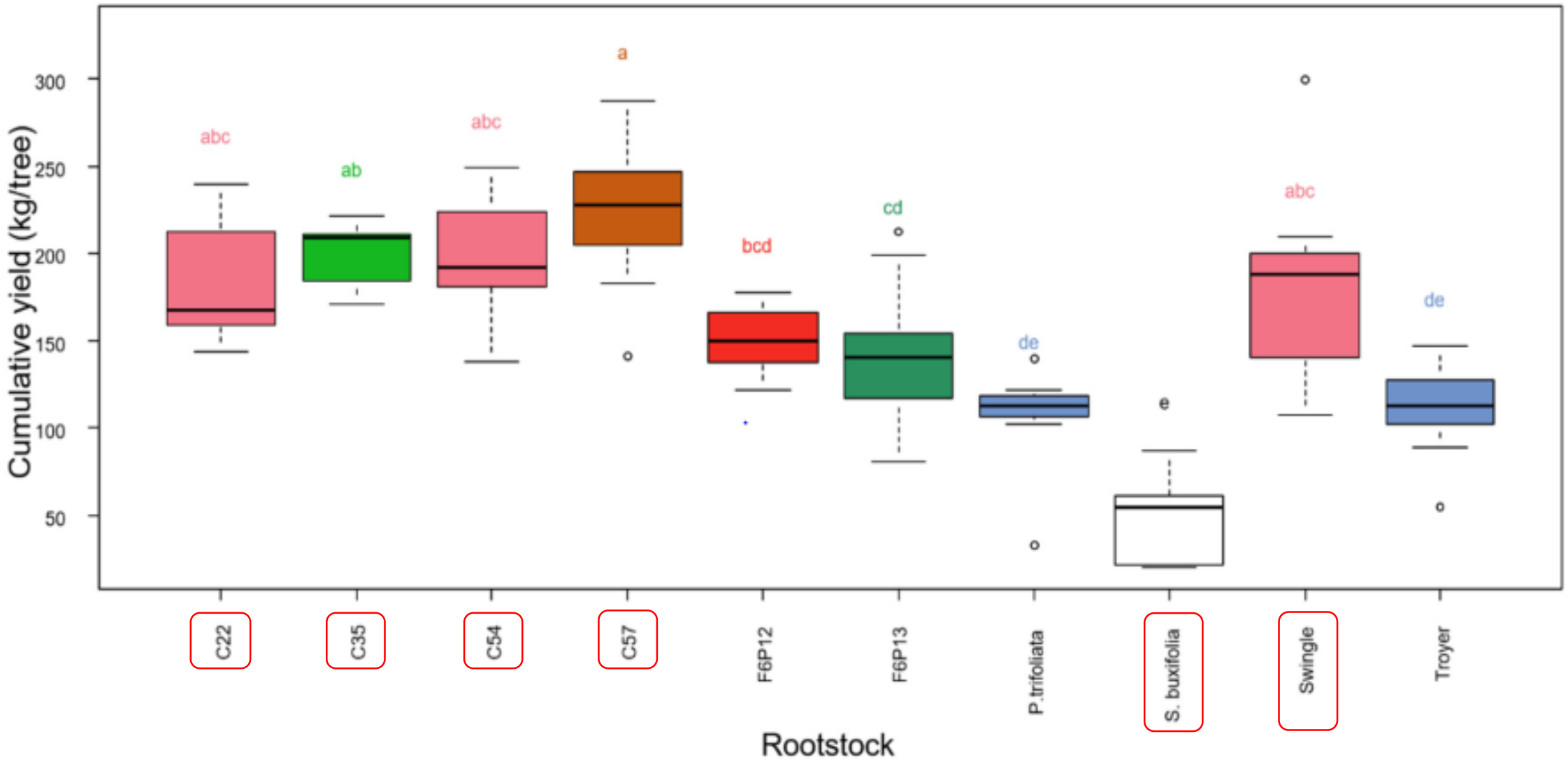


Troyer

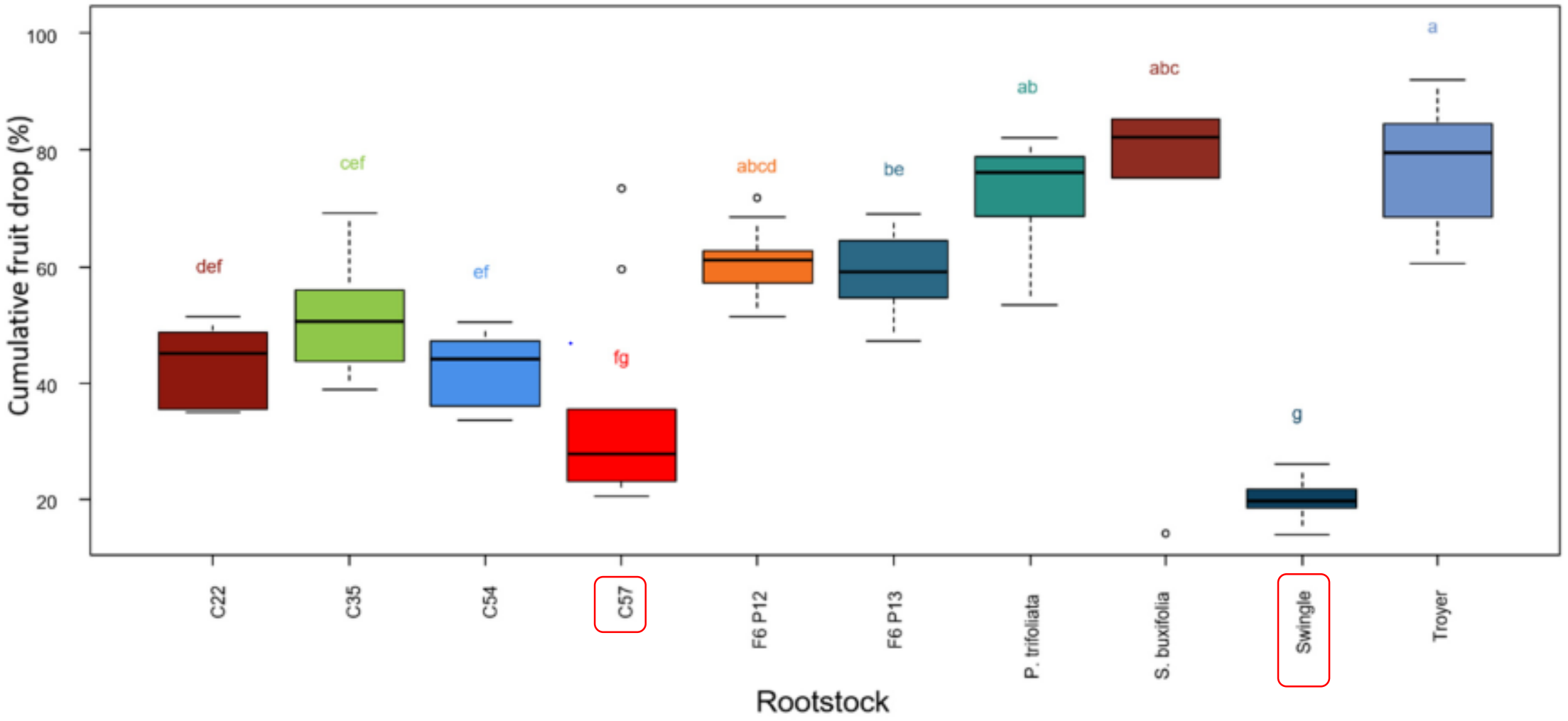


Bitters Carrizo C35 Furr Citrumelo

Produzione cumulata (kg/pianta) in 5 annate produttive nelle piante di Mandared in combinazione con i diversi portinnesti



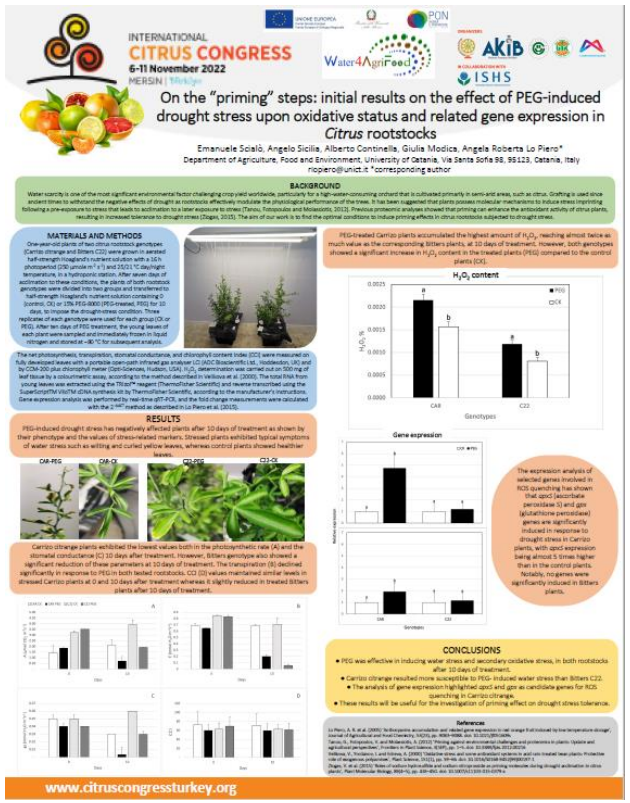
Percentuale di cascola pre-raccolta dei frutti di Mandared in combinazione con diversi portinnesti (2016-2019)

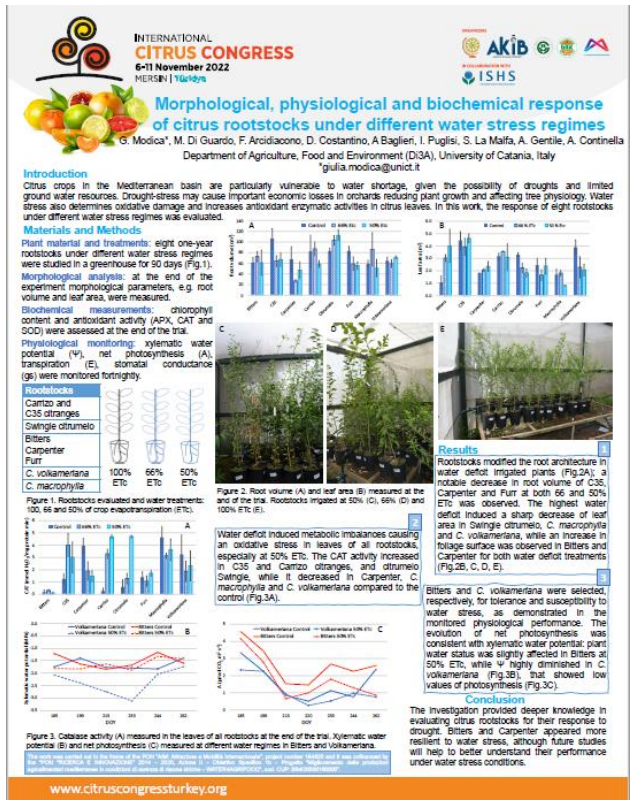


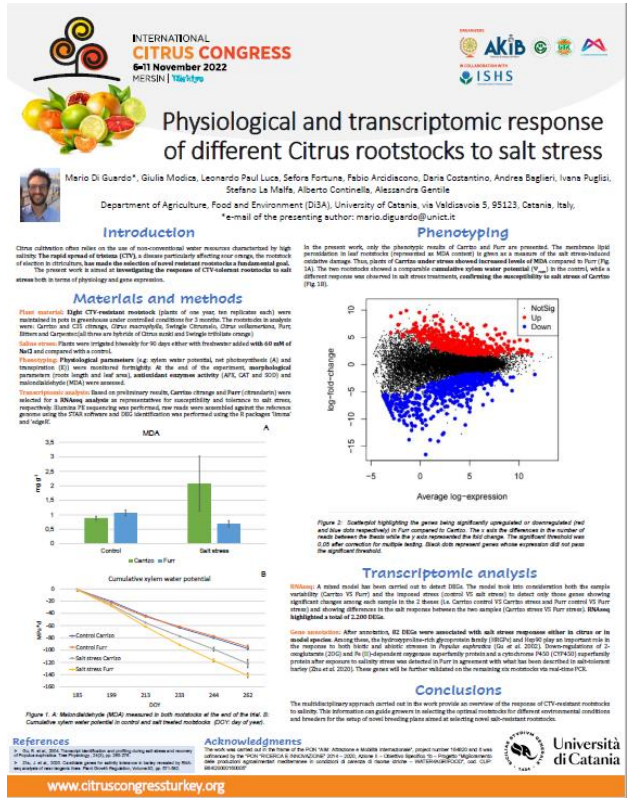
Bitters water stress tolerance

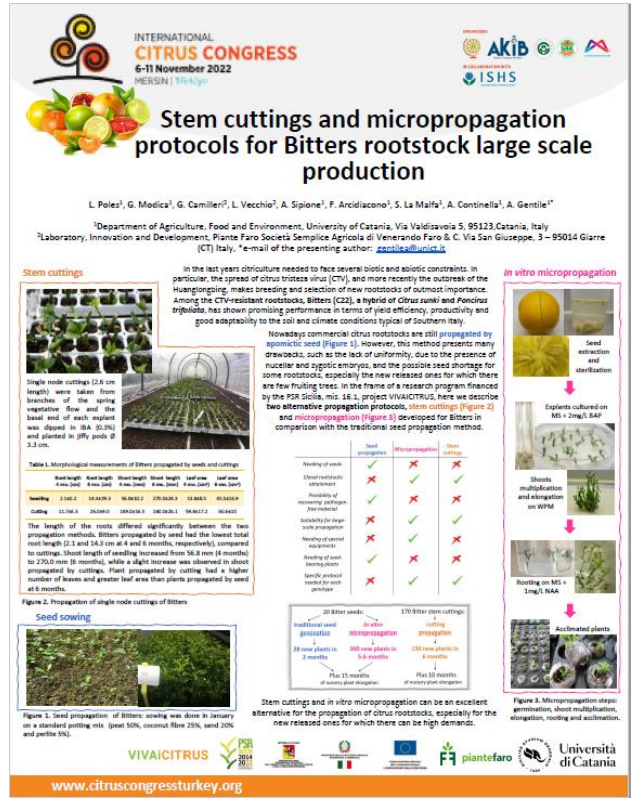
Furr salt stress tolerance

Bitters propagation









UNIONE EUROPEA

FONDO EUROPEO AGRICOLO PER LO SVILUPPO RURALE: L'EUROPA INVESTE NELLE ZONE RURALI

REPUBBLICA ITALIANA

REGIONE SICILIANA
ASSESSORATO REGIONALE
DELL'AGRICOLTURA, DELLO SVILUPPO RURALE
E DELLA PESCA MEDITERRANEA

PSR SICILIA 2014 2020
PROGRAMMA DI SVILUPPO RURALE

IL PROGETTO

VIVAiCITRUS

Università di Catania

piantefaro

Sottomisura 16.1 "Sostegno per la costituzione e la gestione dei gruppi operativi del PEI in materia di produttività e sostenibilità dell'agricoltura"

Progetto

"Introduzione nel sistema vivaistico di nuovi portinnesti di elevato valore agronomico e di protocolli innovativi di propagazione per l'agrumicoltura siciliana"

- Trasferimento del protocollo di micropropagazione dei nuovi portinnesti e ottimizzazione per la produzione di piantine a scopi commerciali

- Trasferimento del protocollo di propagazione attraverso microtalee dei nuovi portinnesti e ottimizzazione per la produzione di piantine a scopi commerciali

- Innesto e diffusione piante da micropropagazione e da microtalea dei nuovi portinnesti

piantefaro
Thinking Green, Growing Green

Cultivar

1. Moro
2. Tarocco Ippolito
3. Tarocco Rosso
4. Tarocco Lempso
5. Tarcco TDV
6. Tarocco Scirè
7. Tarocco Meli
8. Tarocco S. Alfio
9. Navelina
10. Chislett

Portinnesti

1. Citrange Carrizo
2. C35
3. Bitters
4. Carpenter
5. Furr

ITALIA NEXT DOP

1° SIMPOSIO SCIENTIFICO FILIERE DOP IGP

ROMA, 22 FEBBRAIO 2023 - ORE 9.00

ITALIA NEXT DOP – 1° SIMPOSIO SCIENTIFICO FILIERE DOP IGP

Un'evento completamente dedicato ai temi strategici delle Indicazioni Geografiche con sei sessioni scientifiche, una sessione di apertura con interventi di indirizzo, e una sessione di chiusura dove saranno definite delle linee strategiche per la ricerca delle DOP IGP. Il Simposio, organizzato dalla Fondazione Qualivita, è un momento di confronto fra Consorzi di Tutela, Imprese della filiera DOP IGP e mondo della ricerca per una nuova visione della qualità agroalimentare.

SESSIONI **SCIENTIFICHE**

Il programma del Simposio sarà articolato in sei sessioni scientifiche dove saranno **presentati gli studi e le ricerche più avanzate** sui principali settori delle DOP IGP e le applicazioni pratiche dei Consorzi e delle imprese.

1. QUALITÀ IG
2. NORMATIVA IG
3. GOVERNANCE IG
4. SOSTENIBILITÀ IG
5. MERCATI IG
6. MARKETING IG

INFORMAZIONI **PER GLI SPEAKER**

fondazione QUALIVITA


Grazie per l’attenzione
alberto.continella@unict.it