



UNIVERSIDAD AUSTRAL DE CHILE
FACULTAD DE CIENCIAS AGRARIAS Y ALIMENTARIAS

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ALAP
Asociación Latinoamericana de la Papa

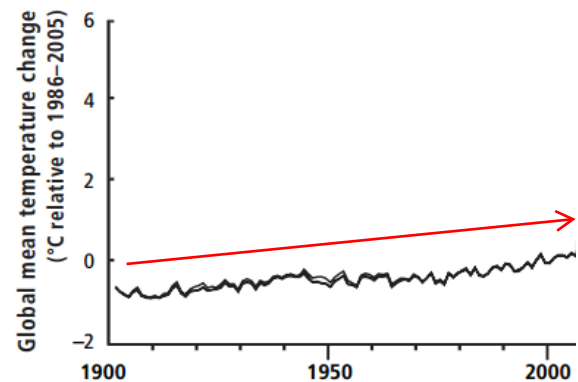
Respuestas fisiológicas, rendimiento y calidad de la papa ante incrementos de la temperatura

Carolina Lizana Campos

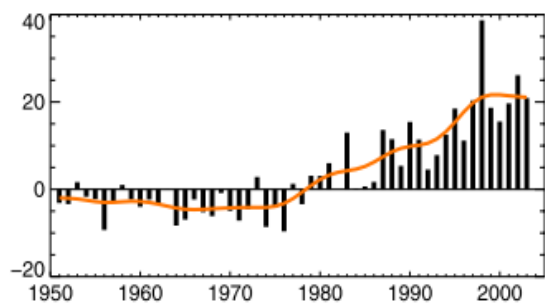
24 marzo 2017



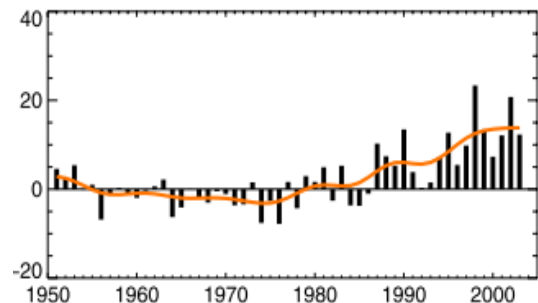
Efectos del cambio climático en la producción global de papa



NOCHES CÁLIDAS



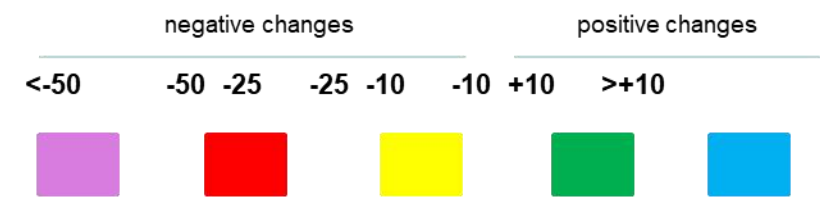
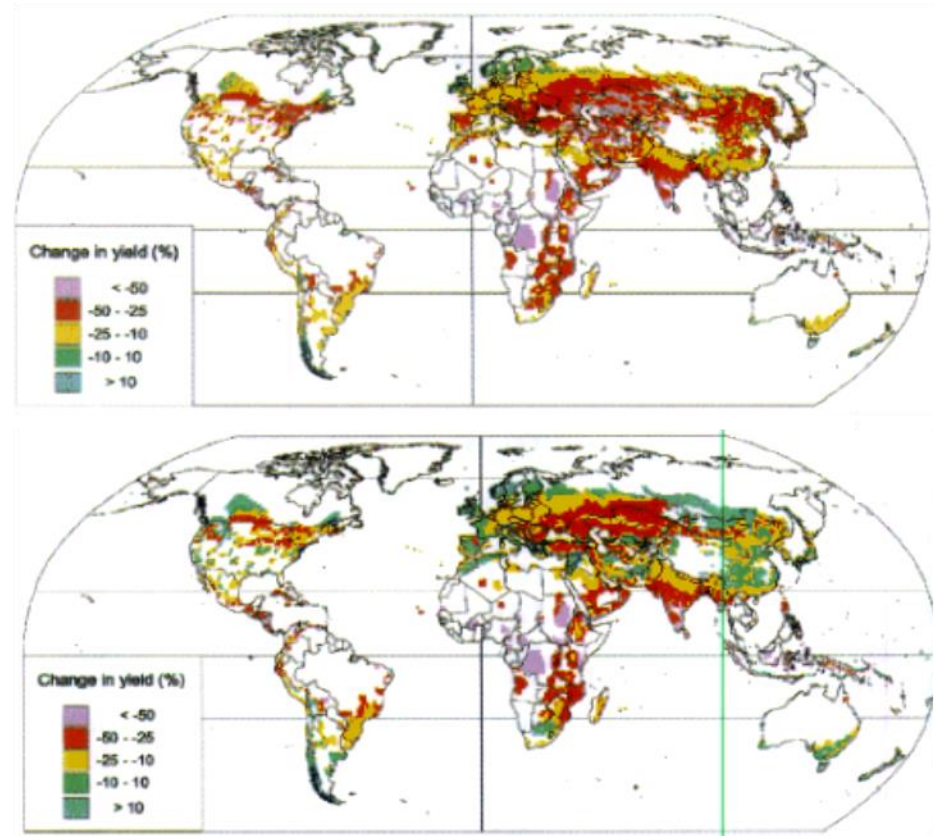
DIAS CÁLIDOS



Alexander et al., 2006

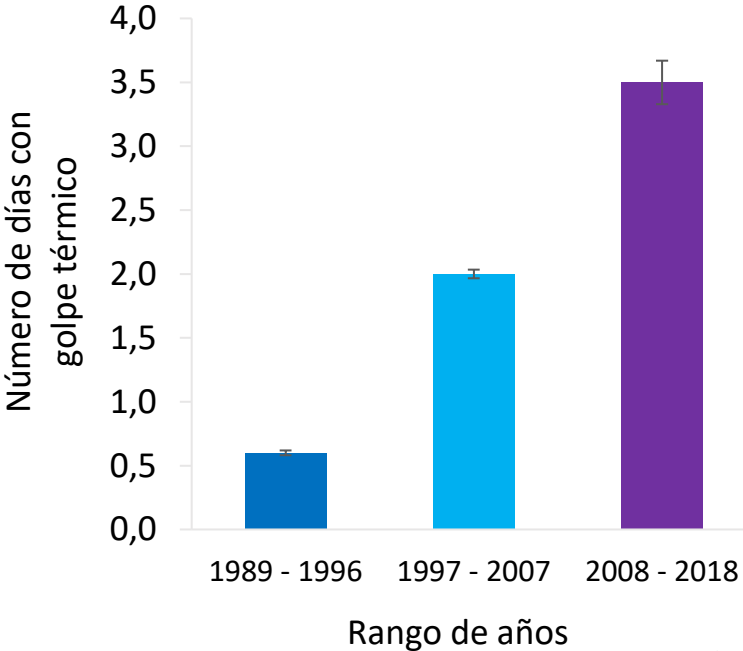
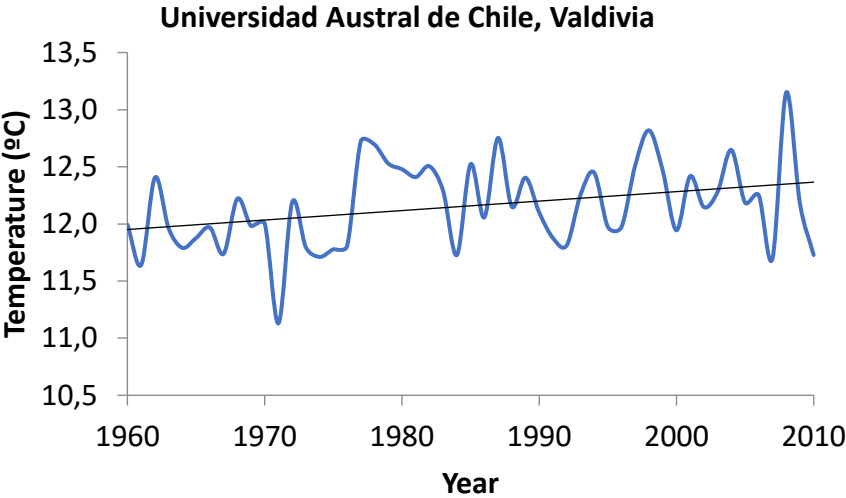
2.1 and 3.2 °C in 2040-69

without adaptation
with adaptation

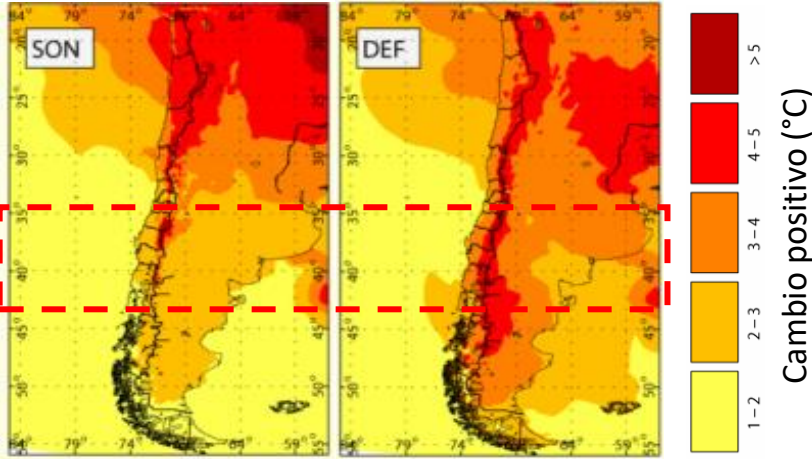


Hijmans, 2003

Condiciones climáticas actuales y futuras en el sur de Chile

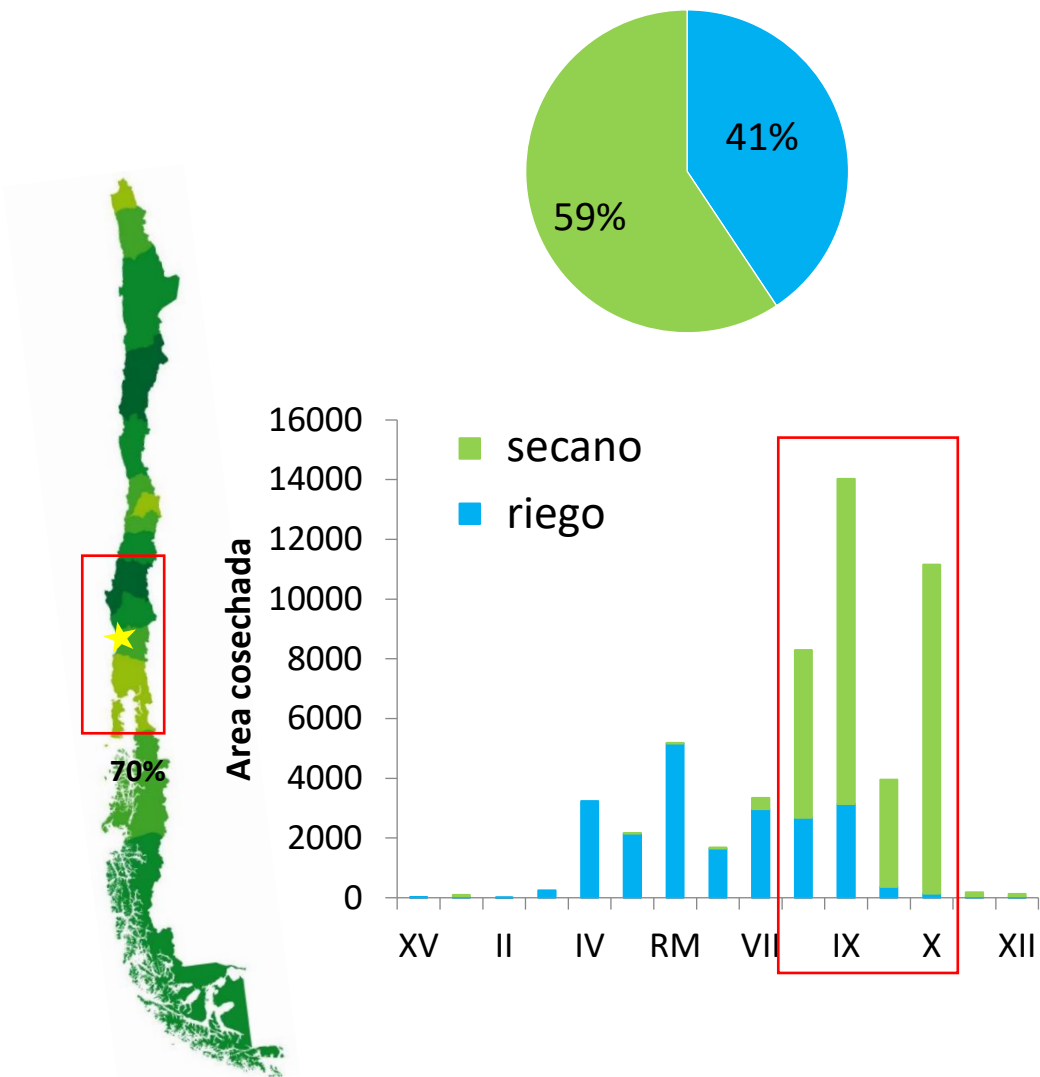


Sanchez F., 2019

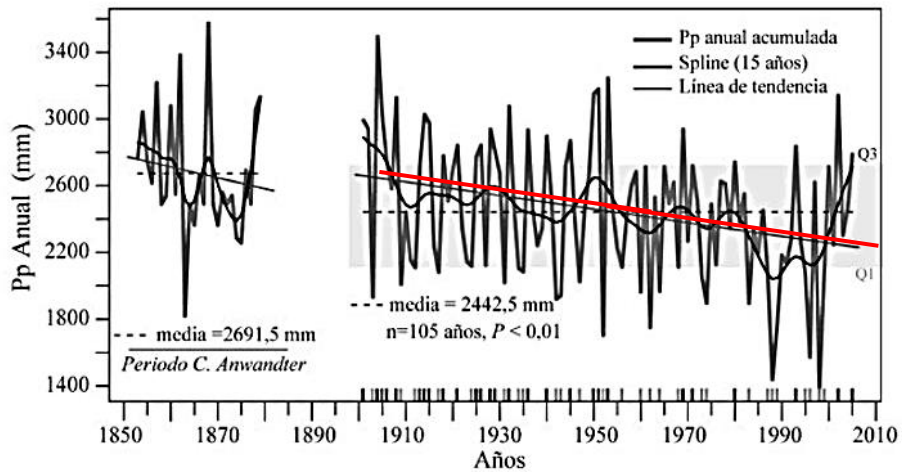
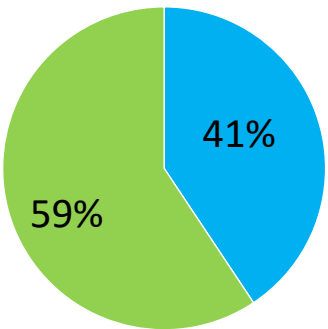


Aumento de temperatura 3 to 5°C

Condiciones climáticas actuales y futuras en el sur de Chile

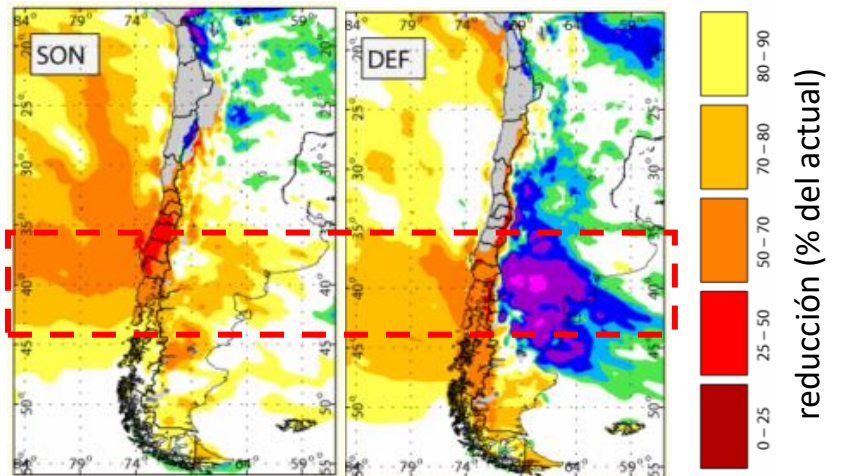


Censo Agropecuario, 2007; Mera et al., 2015



Annual cumulative precipitation time series of Anwandter period (1853 - 1879), and continuous register (1901 - 2005). Annual mean per each period has been represented with dashed lines.

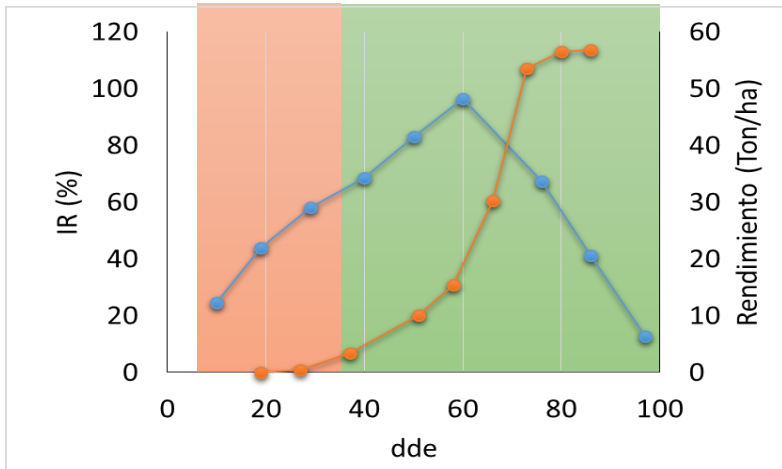
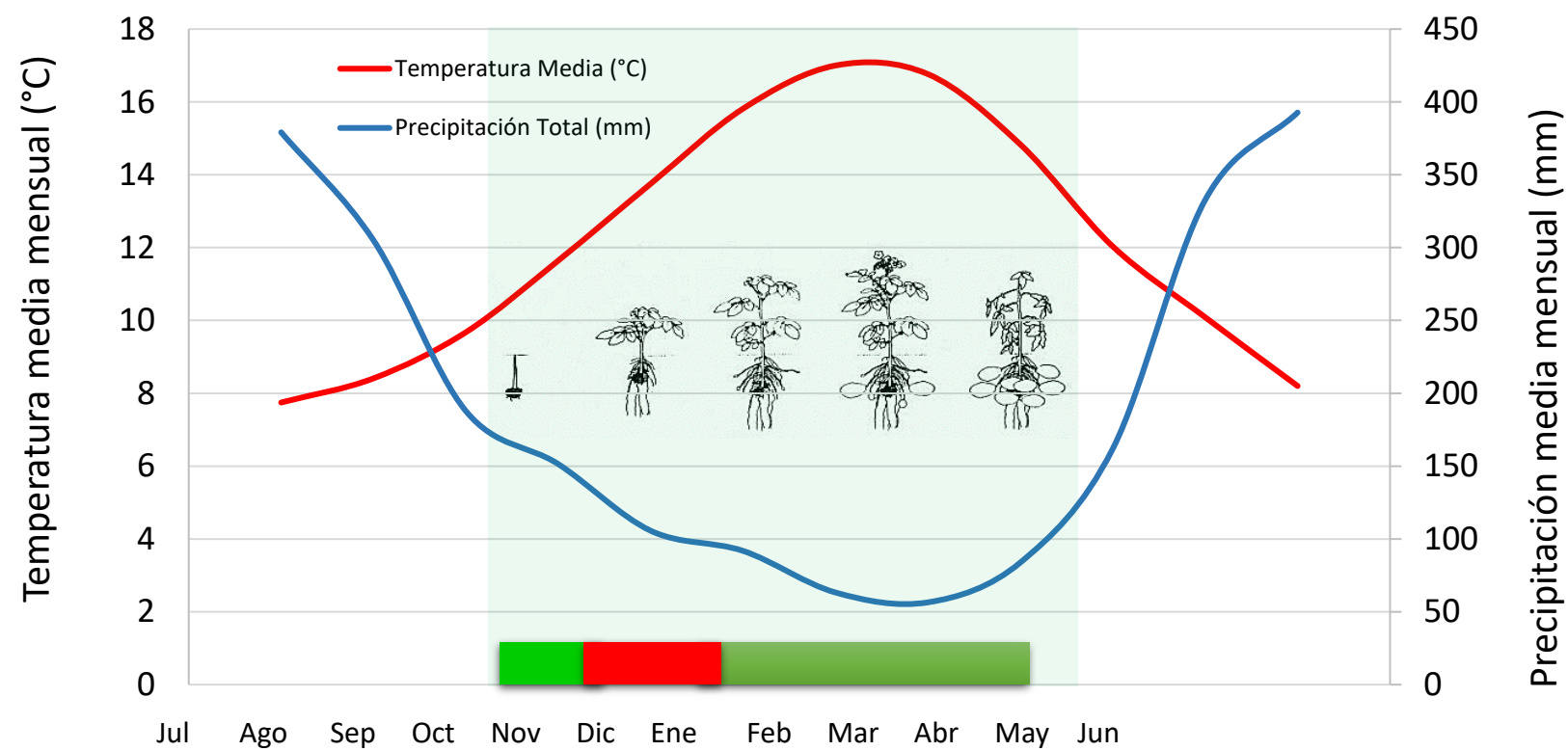
(González-Reyes and Muñoz, 2013)



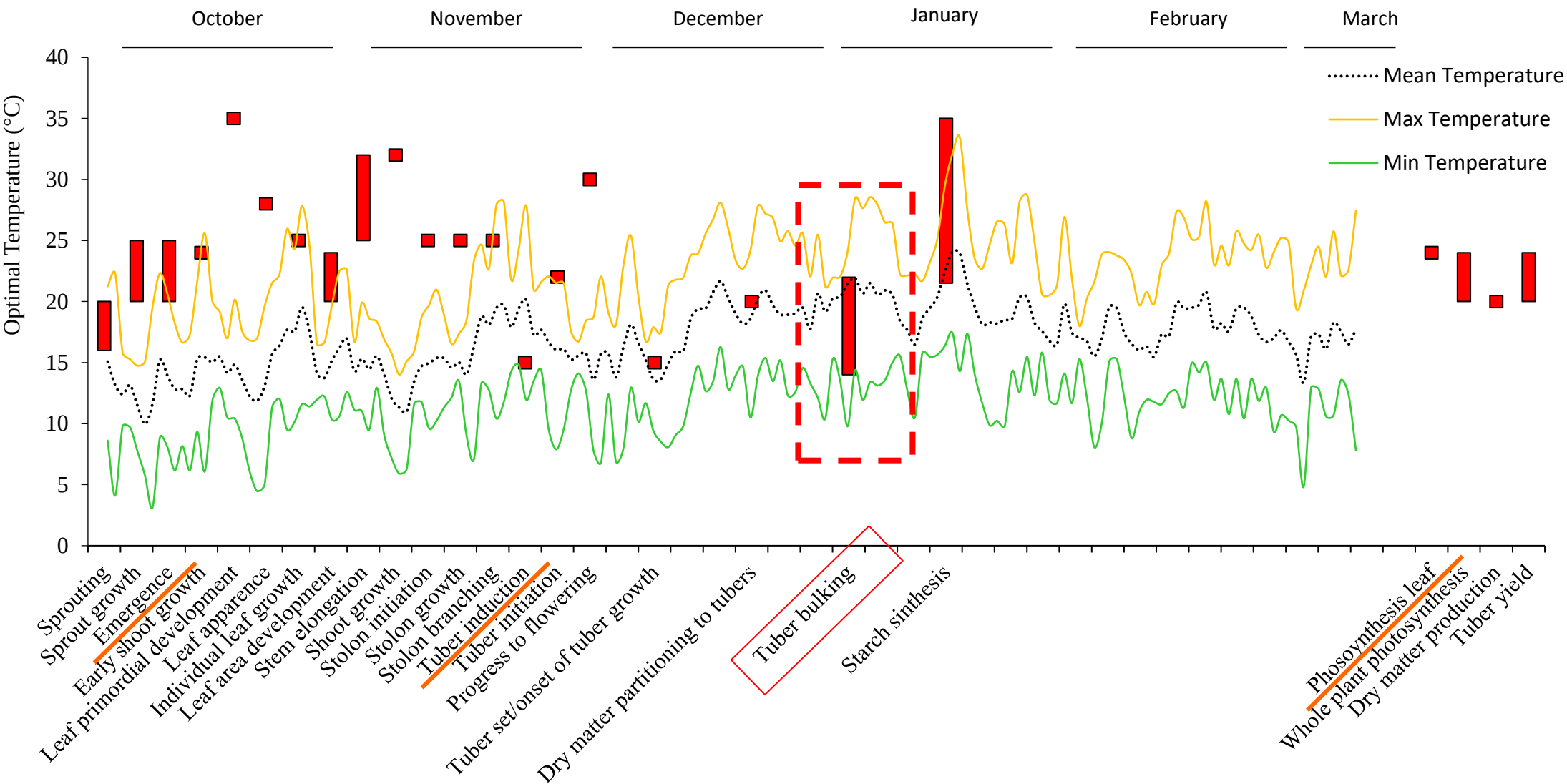
CONAMA, 2006

Reducción de la precipitación 30 to 50%

Condiciones ambientales durante el ciclo del cultivo



Requerimientos térmicos en papa



Tratamientos térmicos en condiciones de campo



TRATAMIENTOS

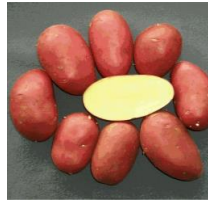
✓ 5 POTATO GENOTYPES

commercial

Desiree



Yagana INIA

**Karú INIA**

Bruja

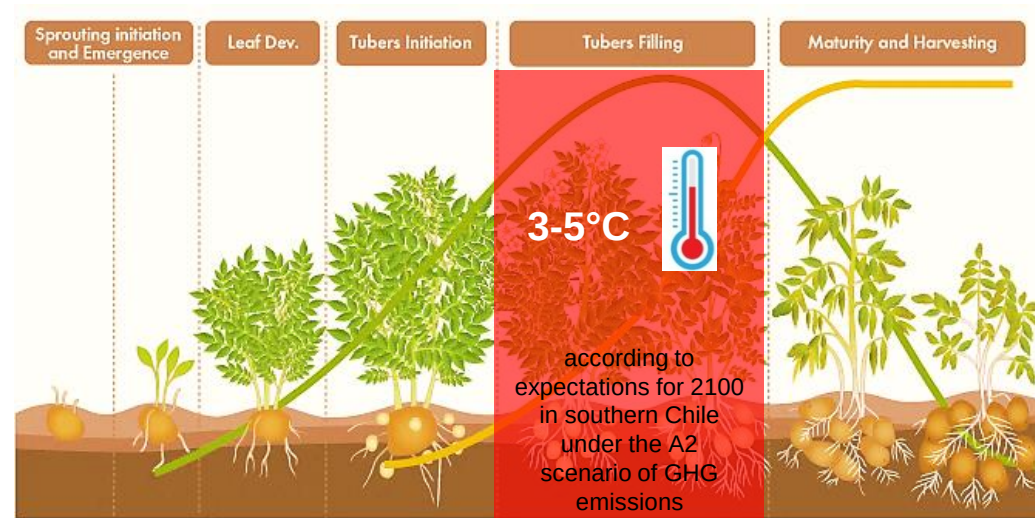


Chona Negra



native

✓ **3 TEMPERATURE REGIMES**



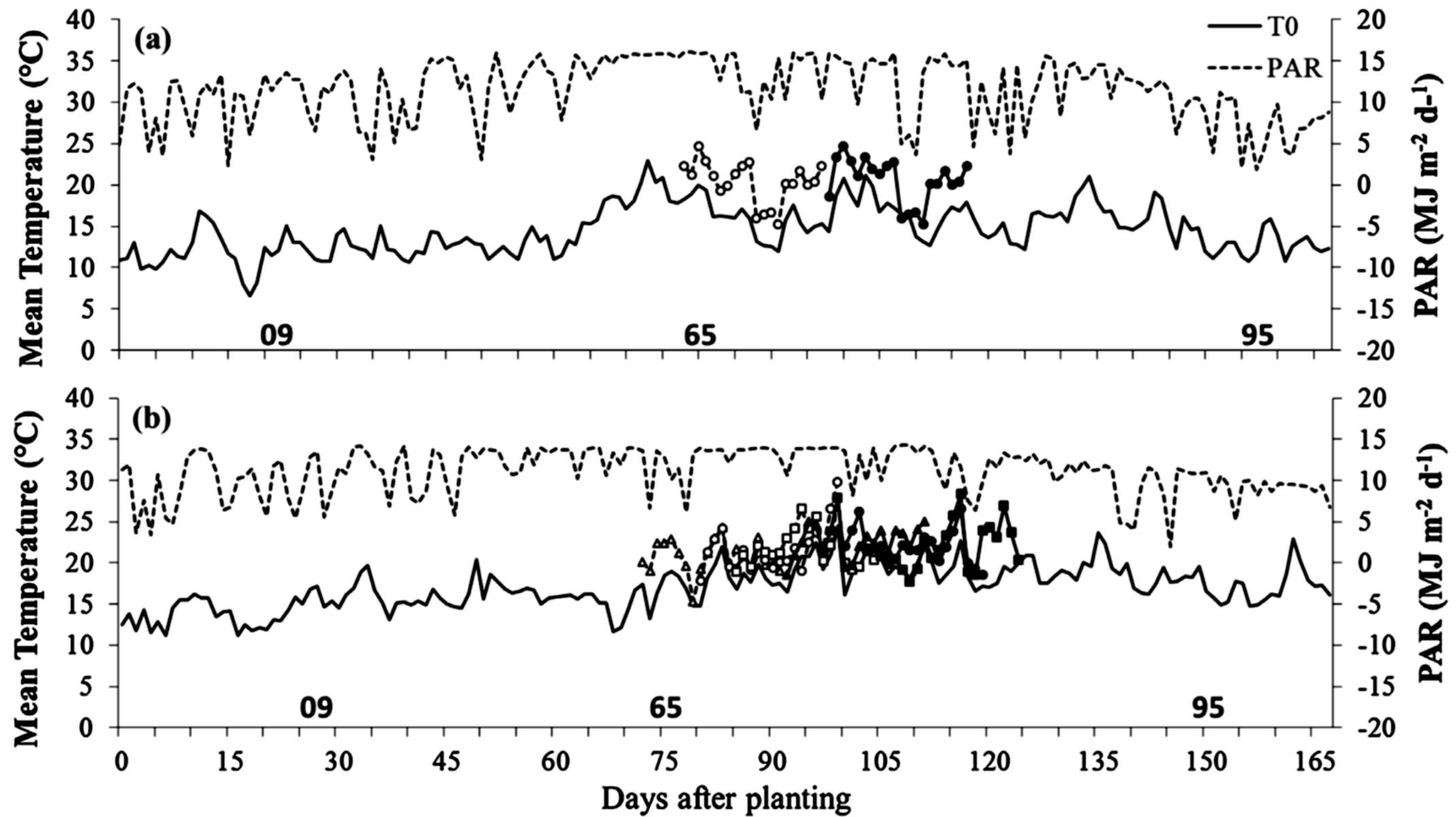
T0

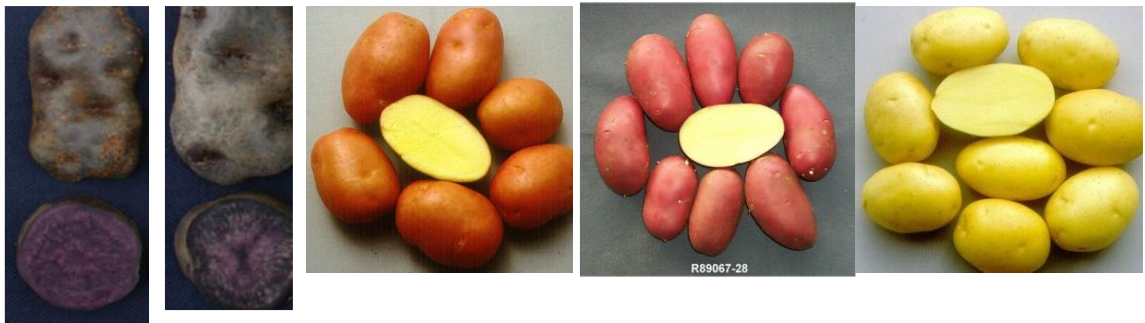
T1

T2

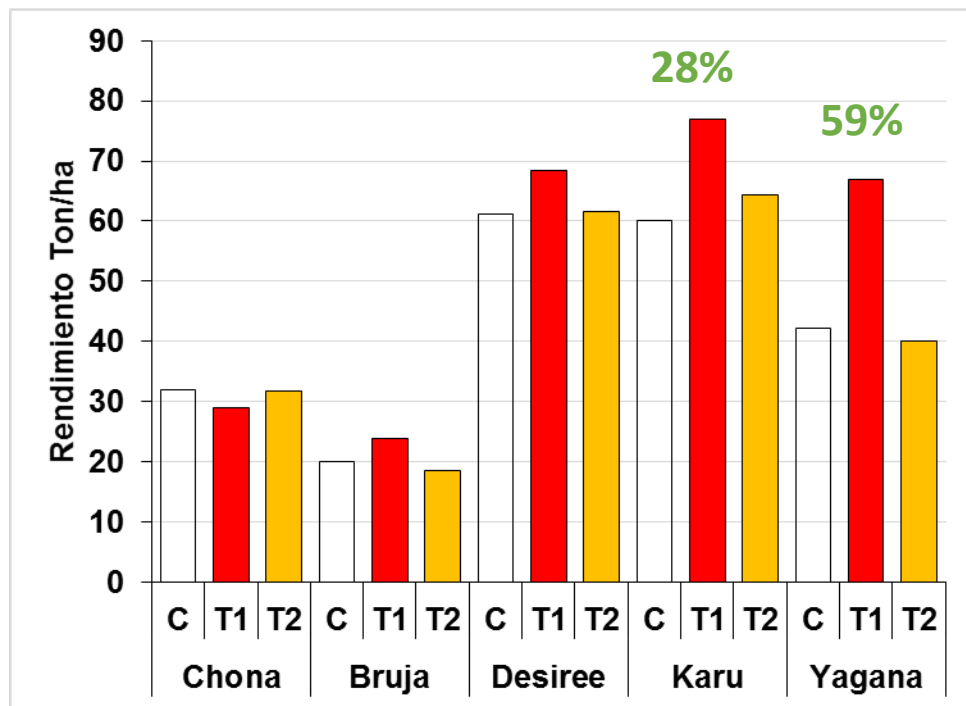


Irrigated experiment

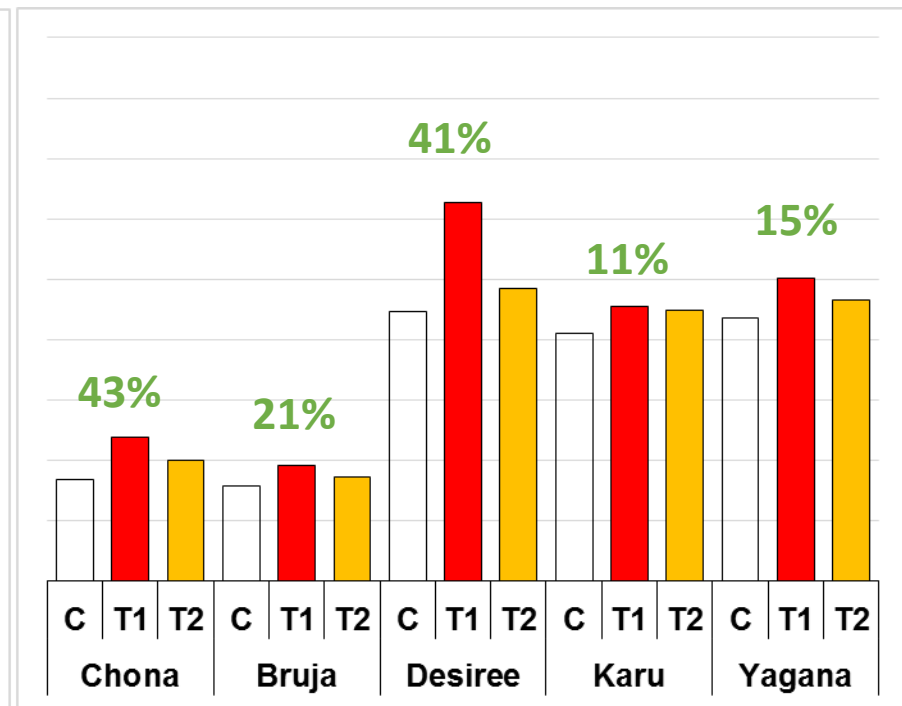




Temporada 1



Temporada 2



20 días de aumento de temperatura (2-3°C) a Inicio (T1) o mediados (T2) del llenado de los tubérculos

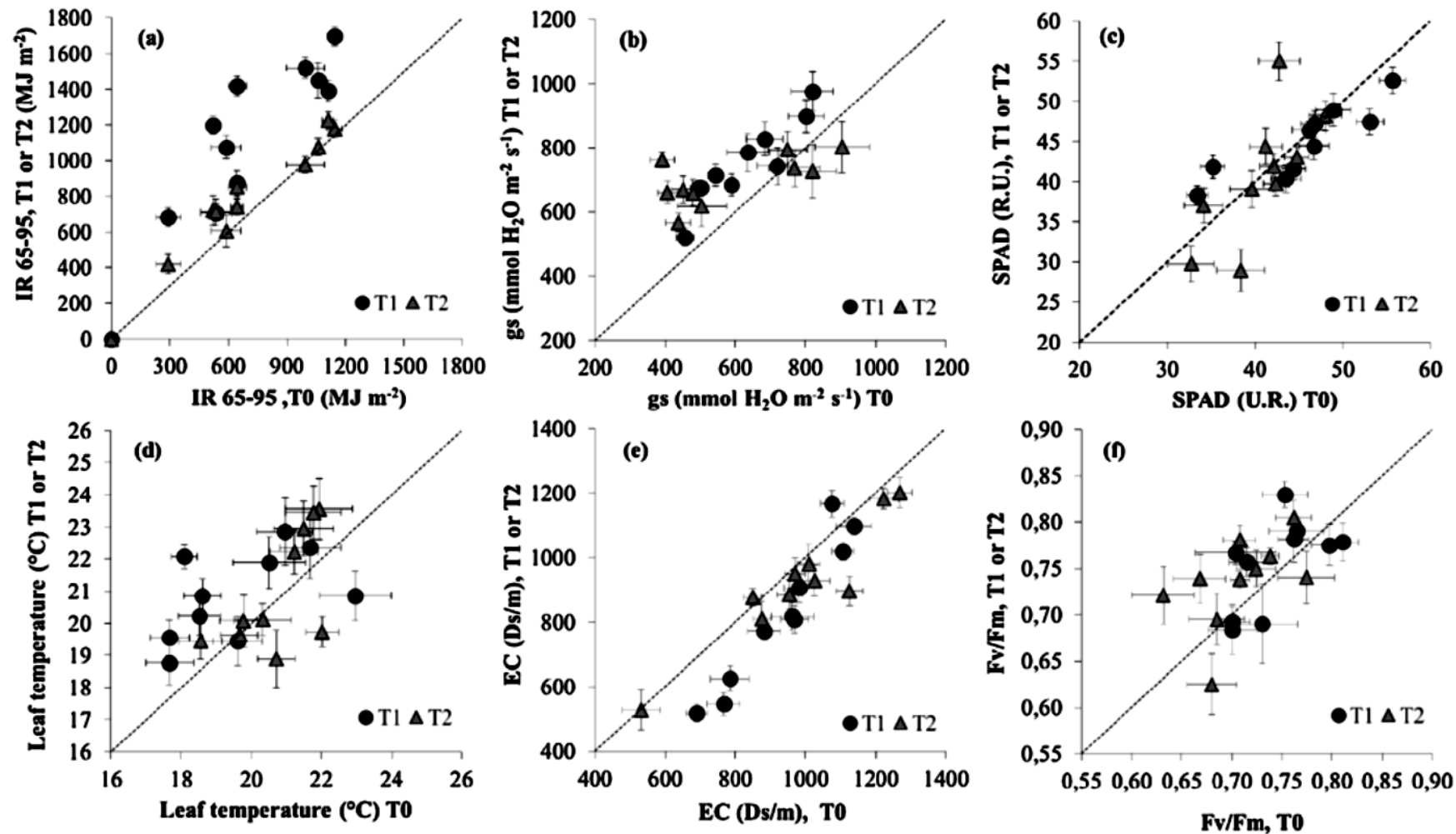
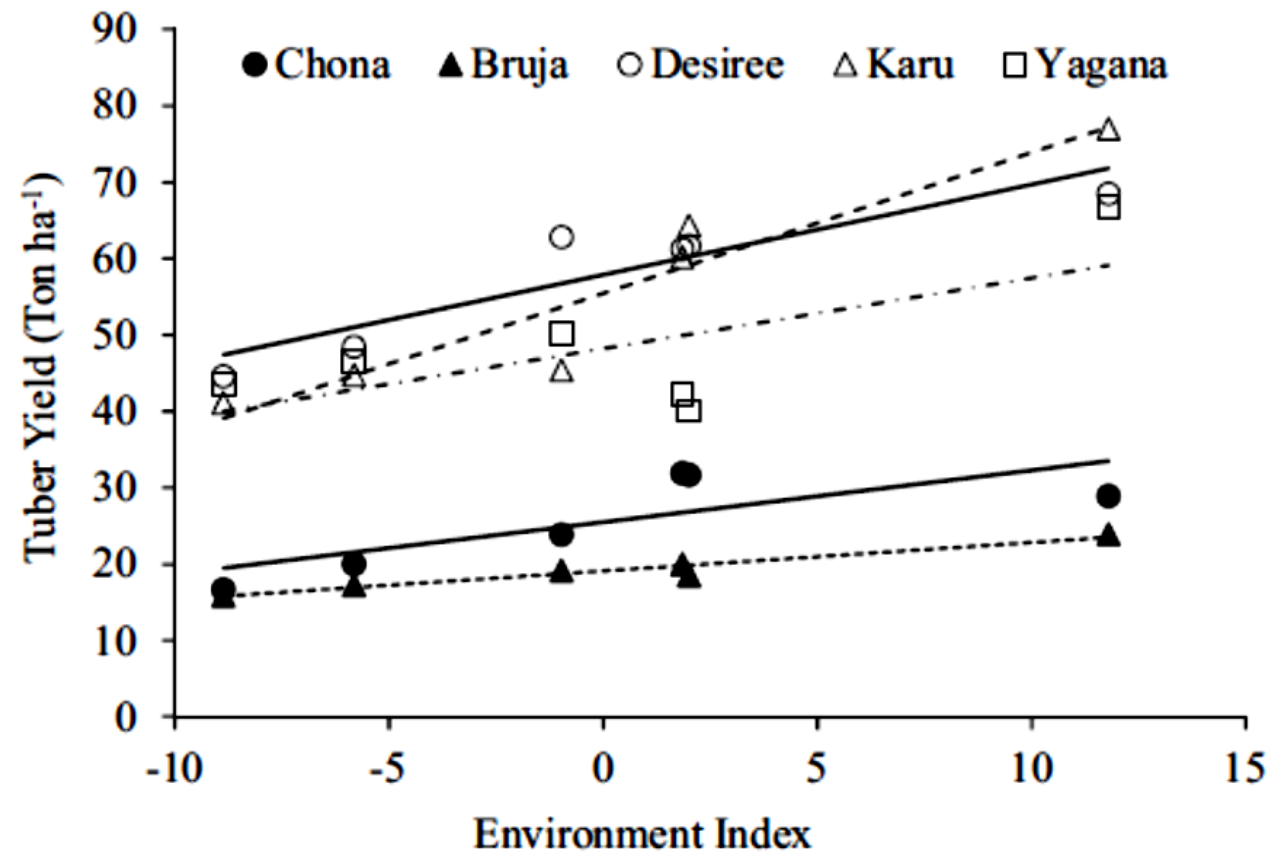


Fig. 5. Relationship between physiological traits of thermal treatments (T1 and T2) and control (T0): a) intercepted radiation between flowering (65) and 50% leaves brownish (95), b) stomatal conductance, c) SPAD (i.e. chlorophyll concentration), d) leaf temperature, e) electric conductivity (i.e. stability of cell membranes), f) Fv/Fm. Line shows the 1:1 ratio.



Genotype	$\bar{x}$	b	S^2d	r^2
Chona	25.5	0.68	20.5	0.49
Bruja	19.1	0.37	0.6	0.93
Desiree	57.9	1.18	16.4	0.81
Karu	55.4	1.84	25.1	0.87
Yagana	48.2	0.93	63.9	0.33

TRATAMIENTOS

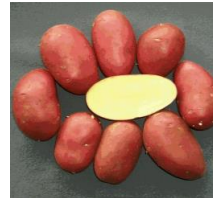
✓ 3 POTATO GENOTYPES

commercial

Desiree



Karú INIA



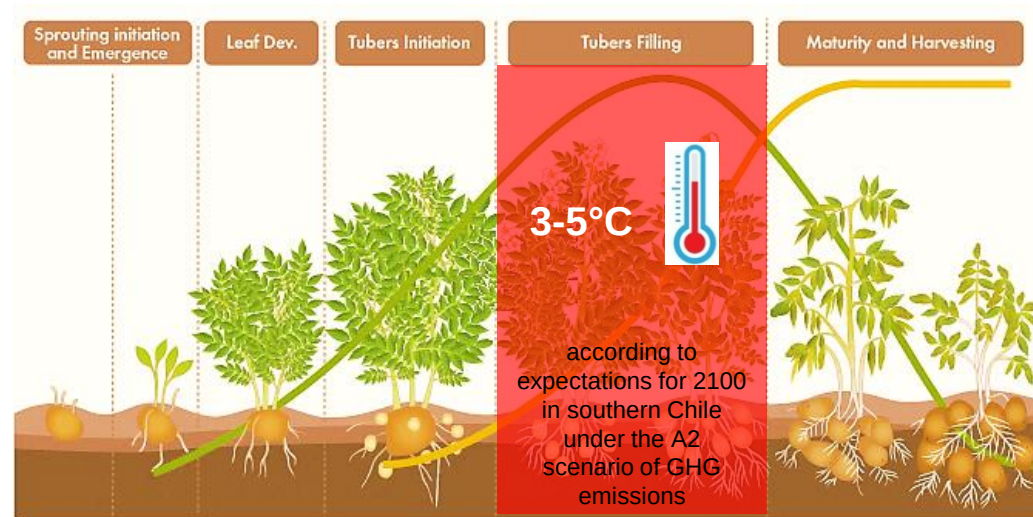
native

**Chona
Negra**



✓ 2 TEMPERATURE REGIMES

✓ 2 WATER CONDITIONS

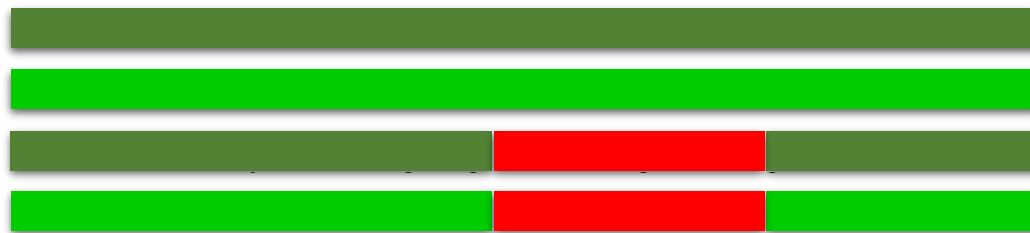


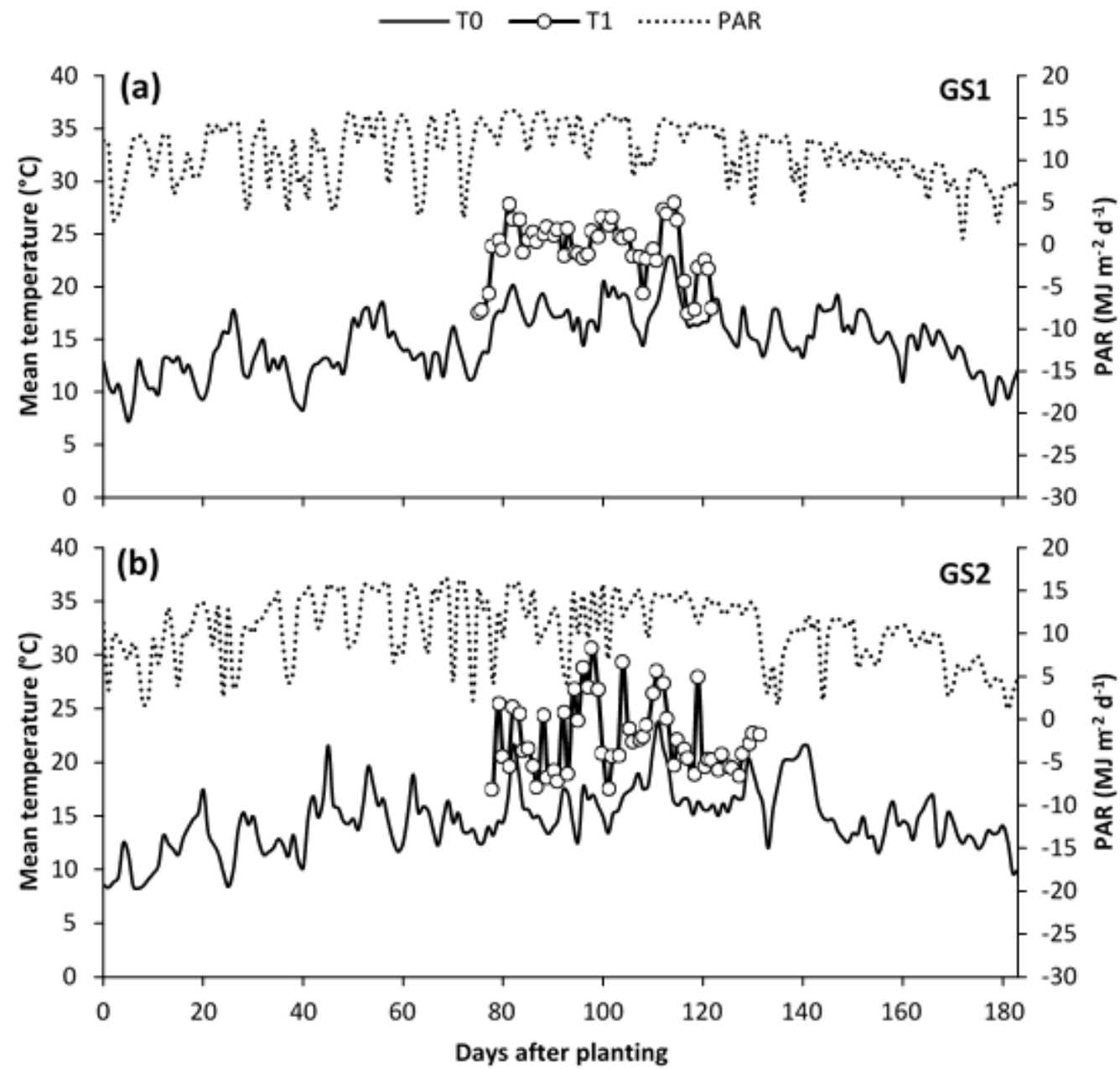
T0, Secano

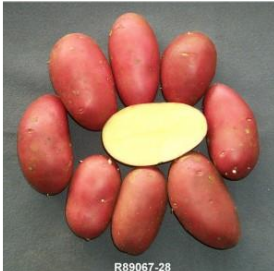
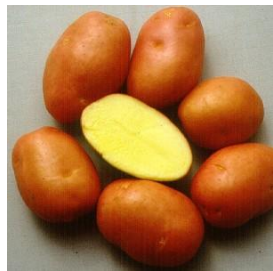
T0, Riego

T1, Secano

T1, Riego





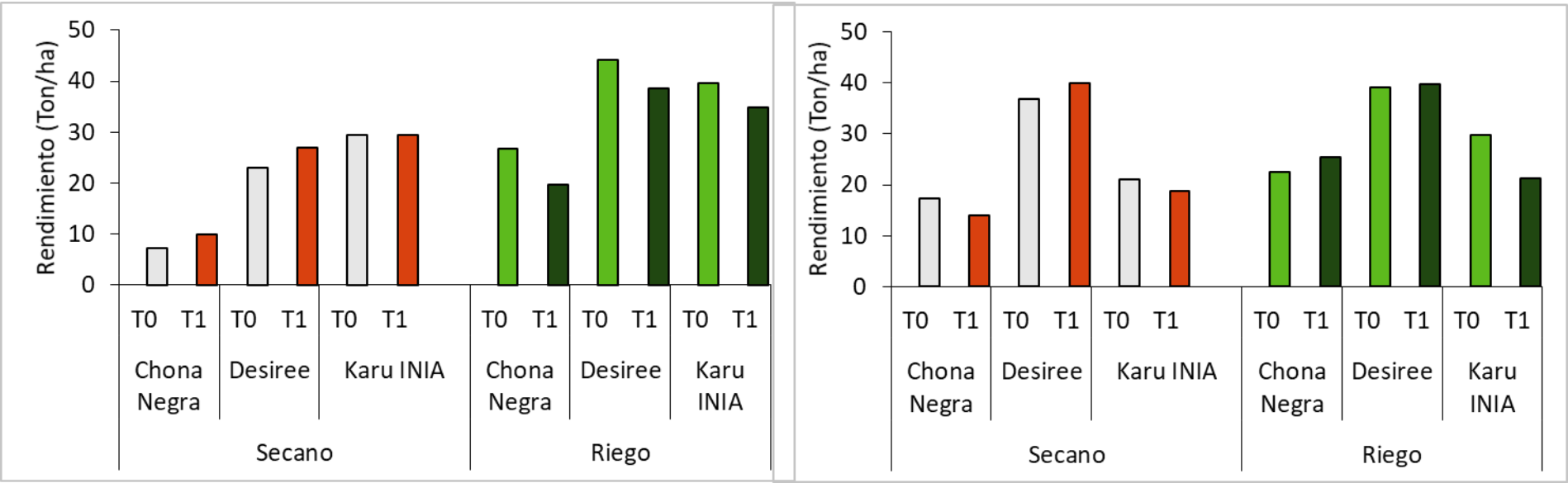


112%

34%

27%

Aumento del rendimiento con riego



40 días de aumento de temperatura (2-3°C) durante el llenado de los tubérculos (T1)

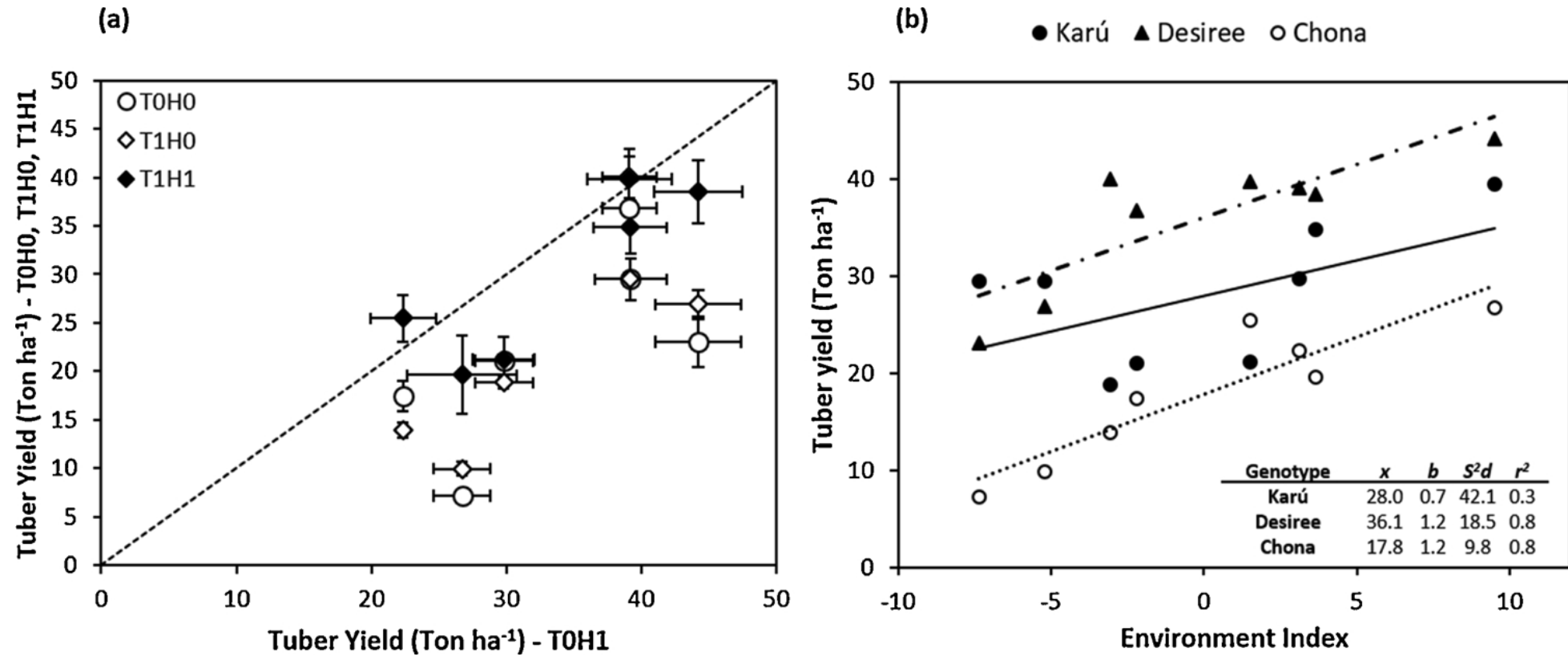
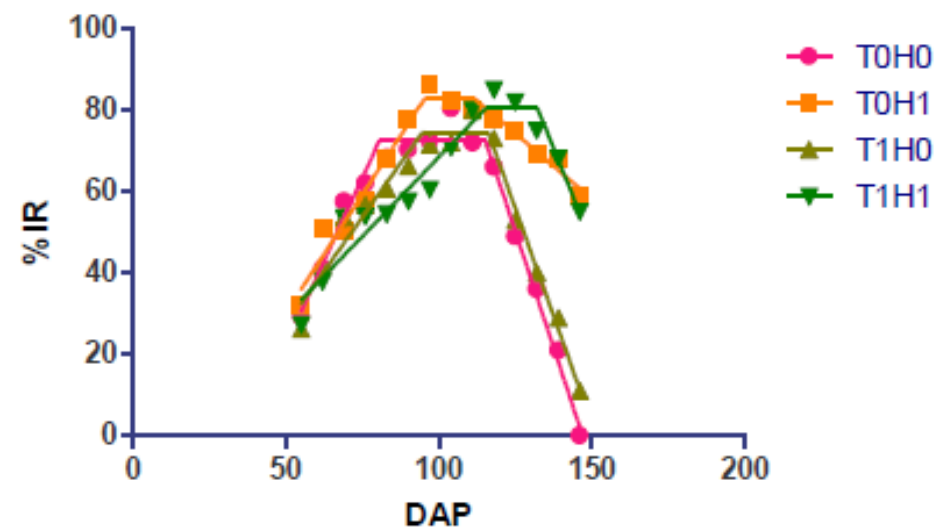
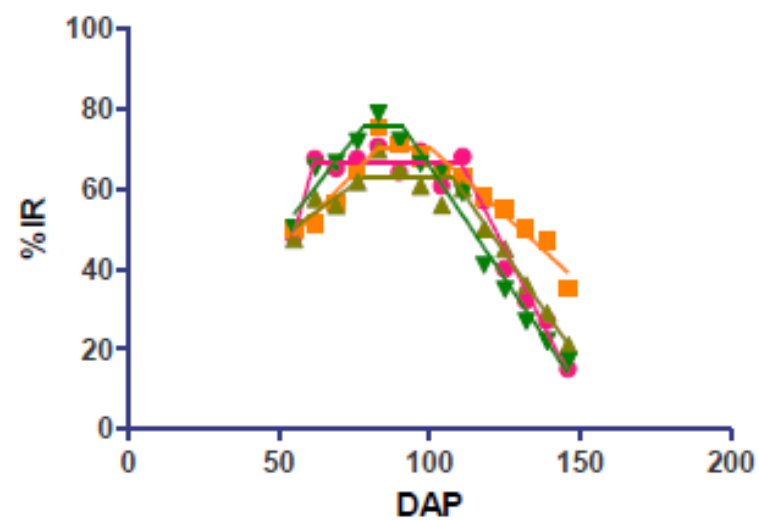


Fig. 3. (a) Relationships between tuber yield at T0H0, T1H0, T1H1 and control T0H1, for three potato genotypes in two growing seasons (complete data set). (b) Regressions of tuber yield means of three genotypes, on an environmental index. Treatments: T0H0, ambient temperature under rainfed conditions; T1H0, high temperature under rainfed conditions; T0H1, ambient temperature under irrigation conditions; T1H1, high temperature under irrigation conditions. Bars indicate standard error. Line shows the 1:1 ratio.

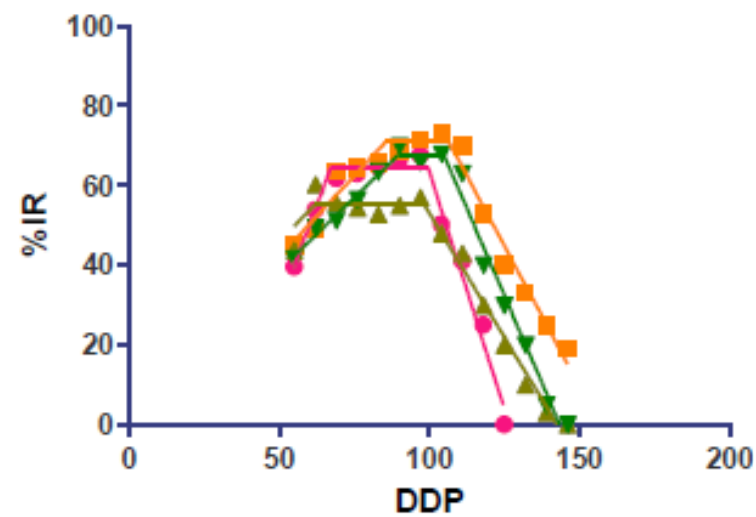
Chona - GS2



Desiree - GS2



Karu -GS2



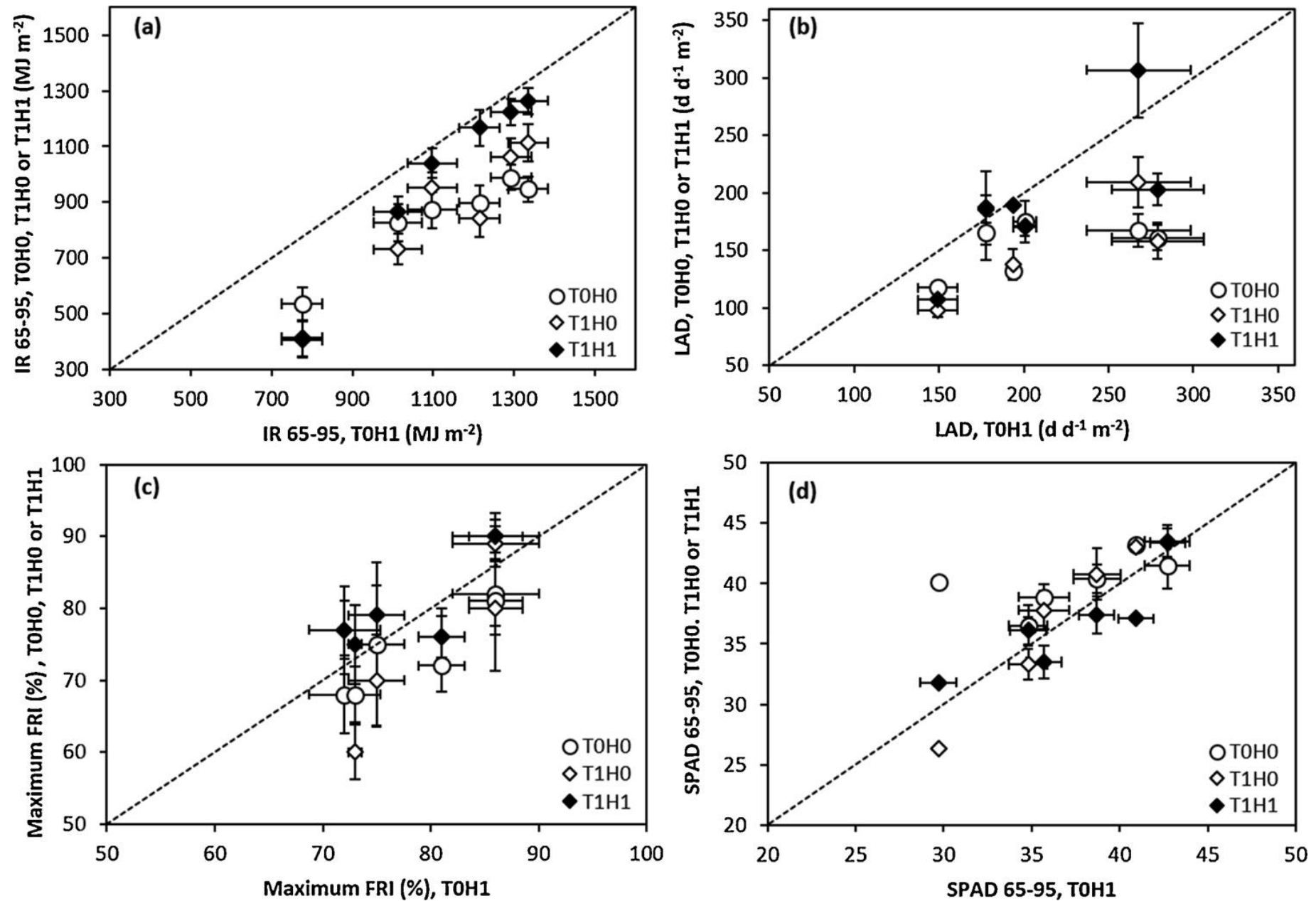


Fig. 5. Relationship between biomass and physiological traits at T0H0, T1H0, T1H1 and control T0H1: (a) intercepted radiation between flowering (65) and 50 % leaves brownish (95), (b) maximum fraction of intercepted radiation (%) during crop cycle, (c) leaf area duration (LAD), (d) SPAD (i.e. chlorophyll concentration) between flowering (65) and 50 % brownish leaves (95). Complete data set of three potato genotypes and two growing seasons. Treatments: T0H0, ambient temperature under rainfed conditions; T1H0, high temperature under rainfed conditions; T0H1, ambient temperature under irrigation conditions; T1H1, high temperature under irrigation conditions. Bars indicate standard error. Line shows the 1:1 ratio.

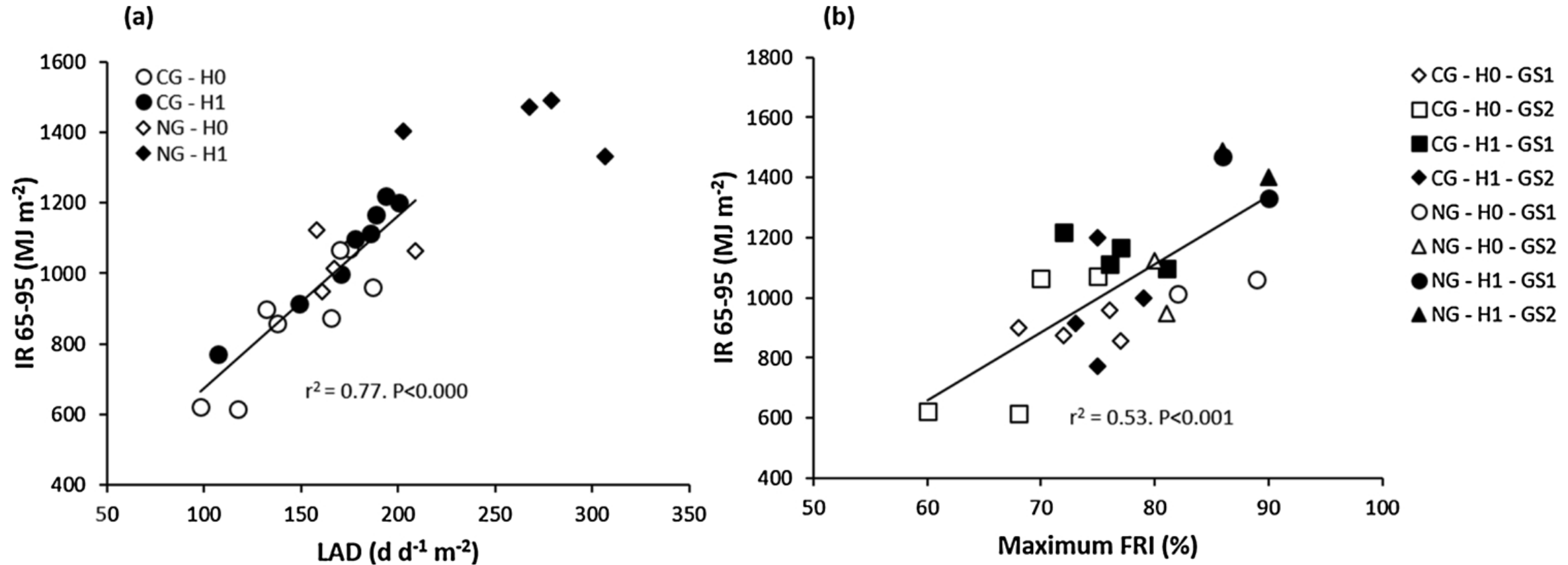
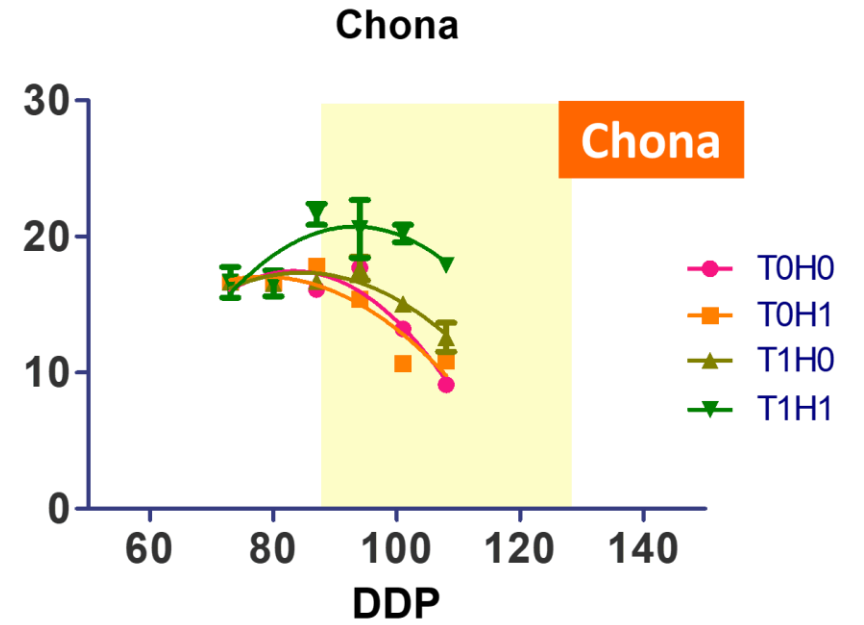
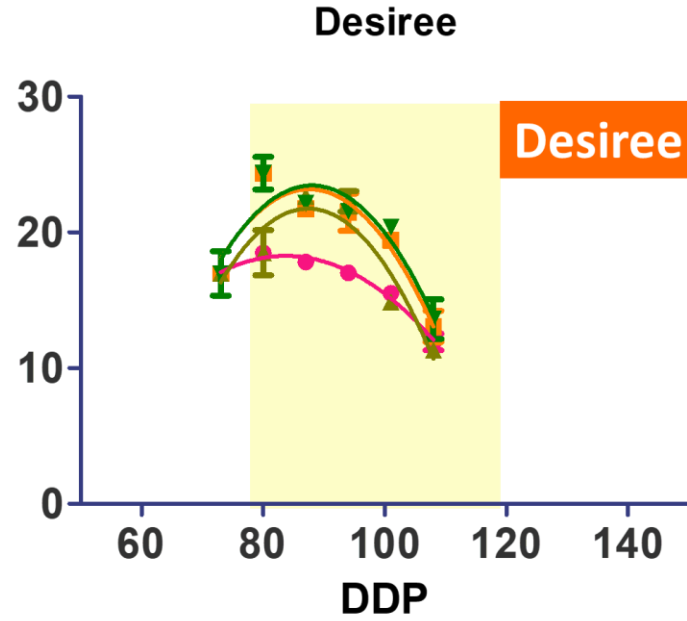
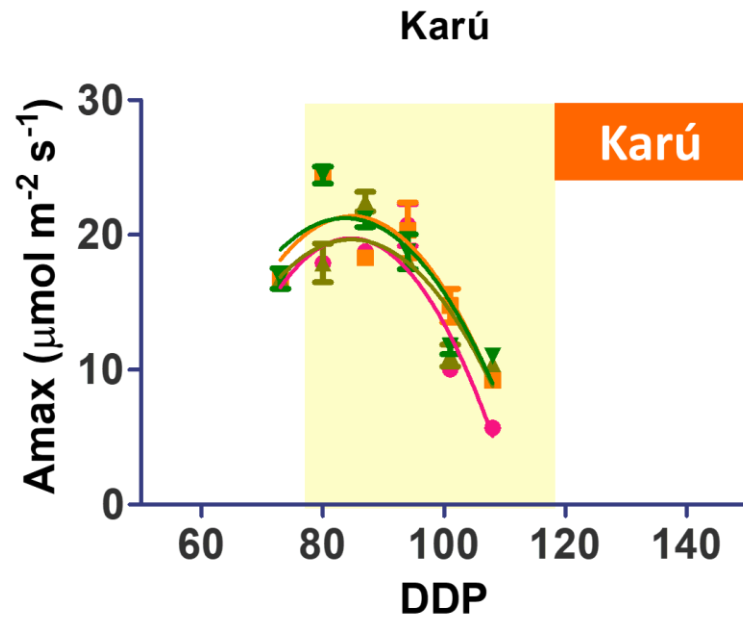
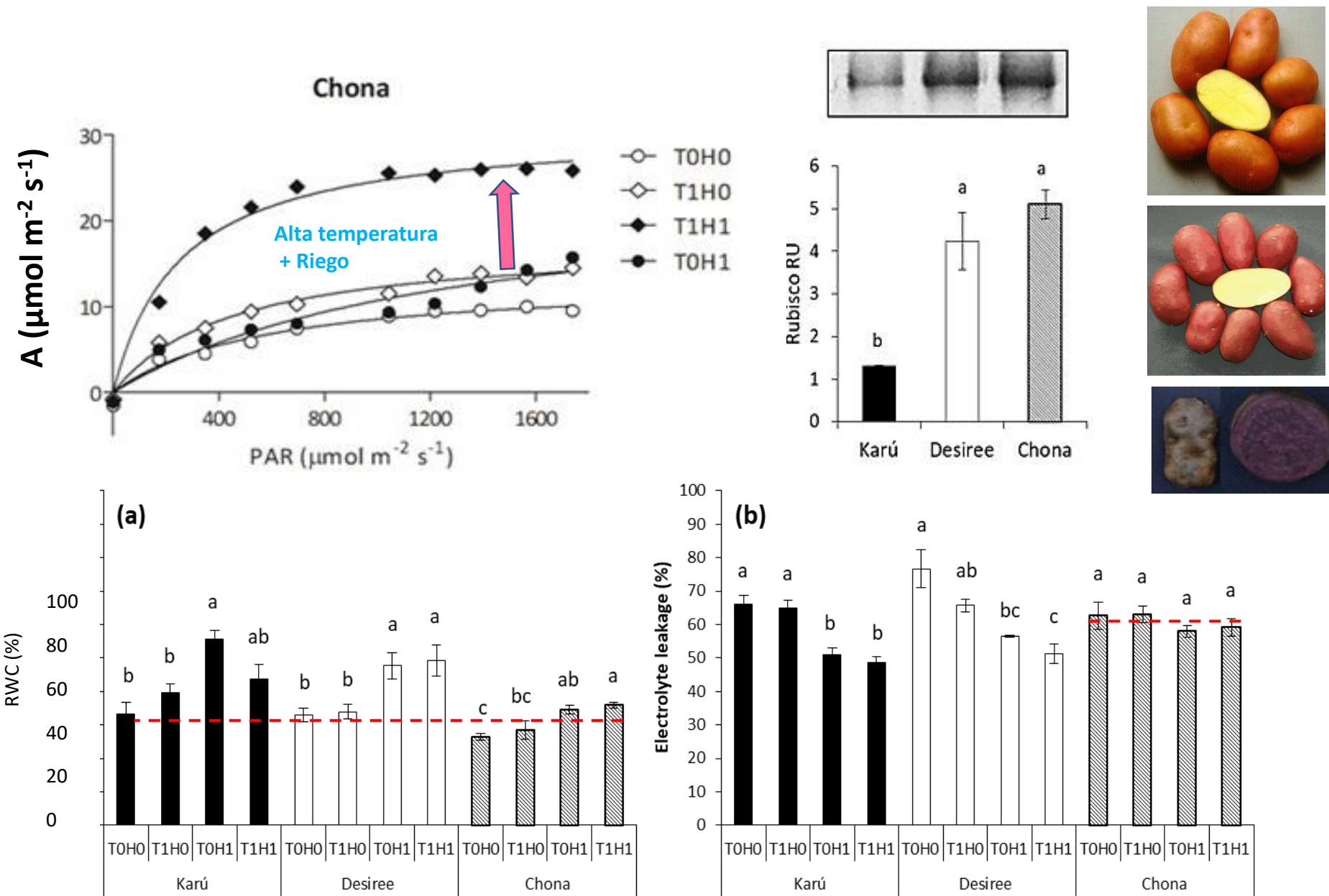


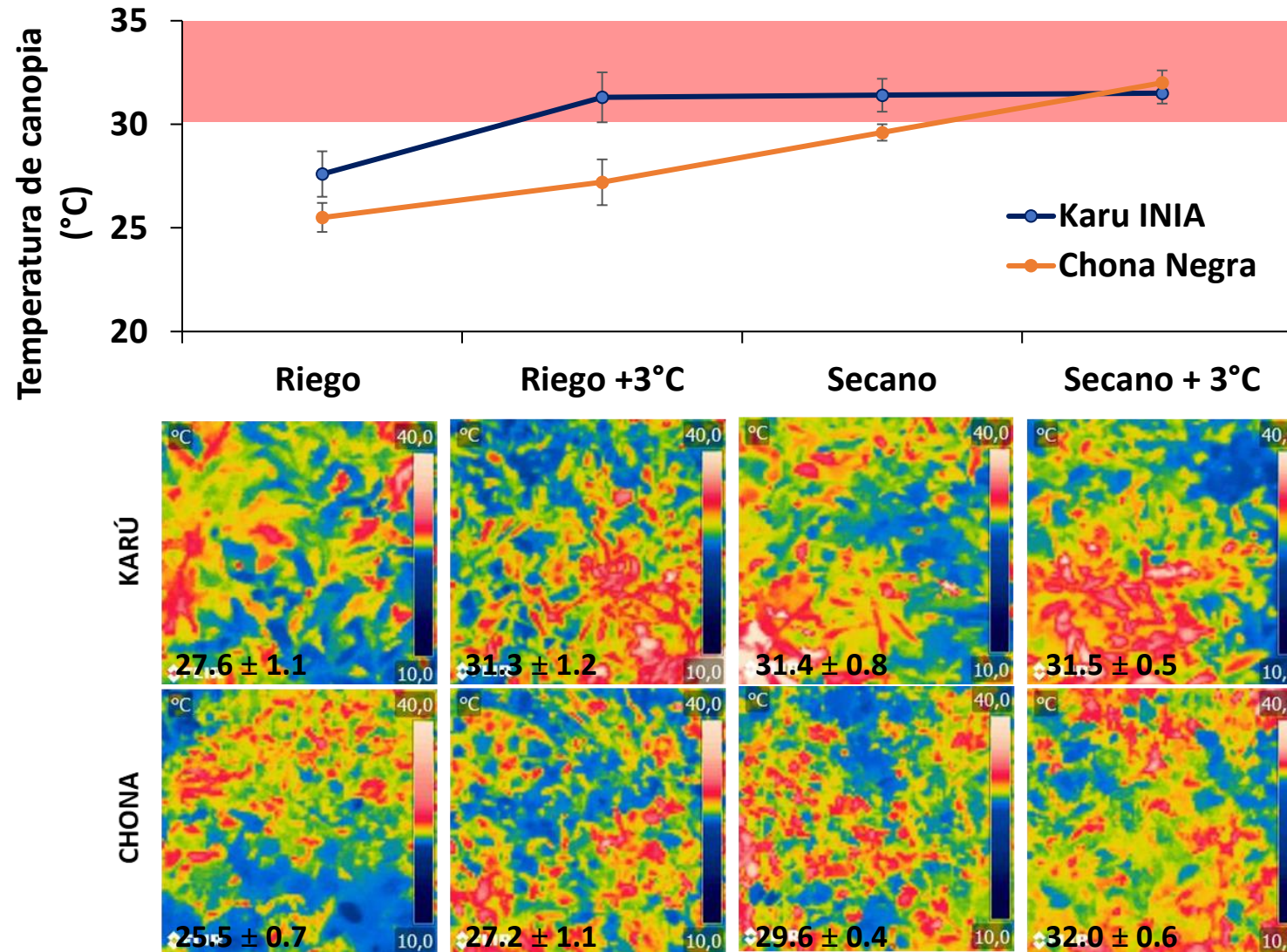
Fig. 6. Relationship between cumulative intercepted radiation (IR) during flowering to 50 % of brownish leaves (FLO-PM) and (a) leaf area duration (LAD) and (b) maximum fraction of intercepted radiation (%) during crop cycle. CG: commercial genotypes, NG: native genotype, H0: rainfed condition, H1: irrigation condition, GS1: first growing season, GS2: second growing season.



Capacidad fotosintética

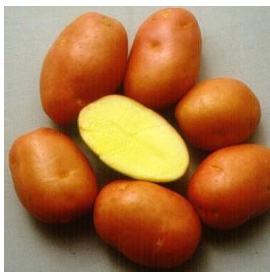


Temperatura de canopia

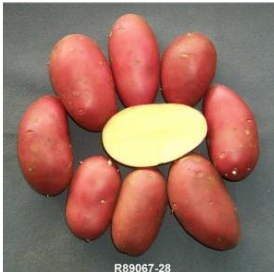




129%

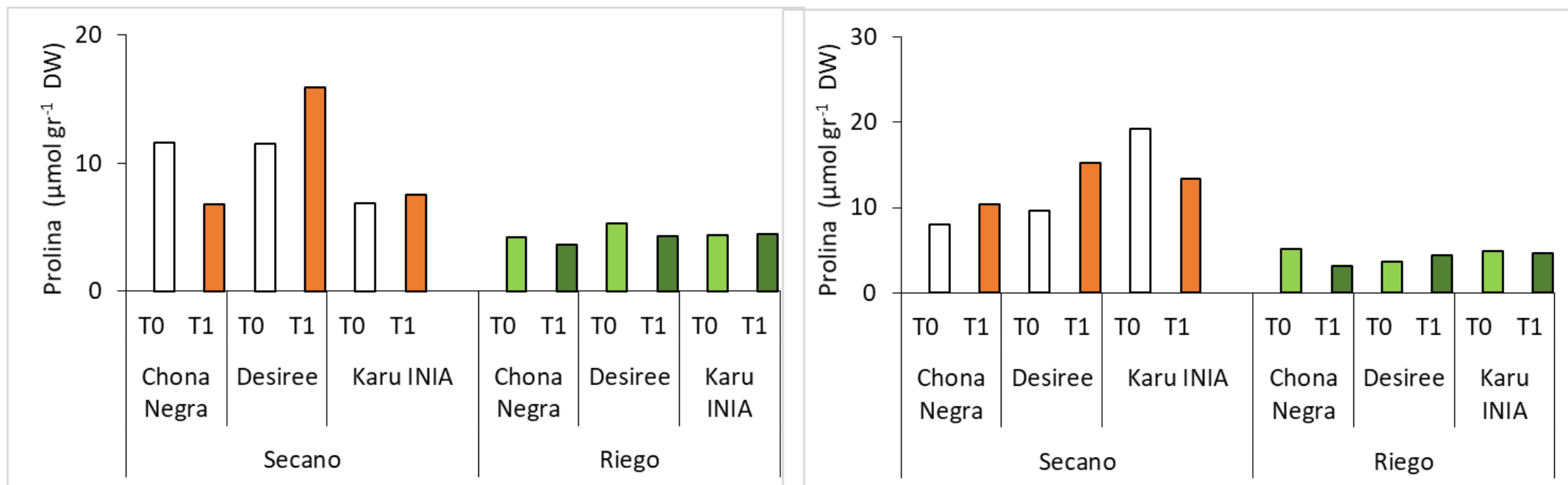


196%

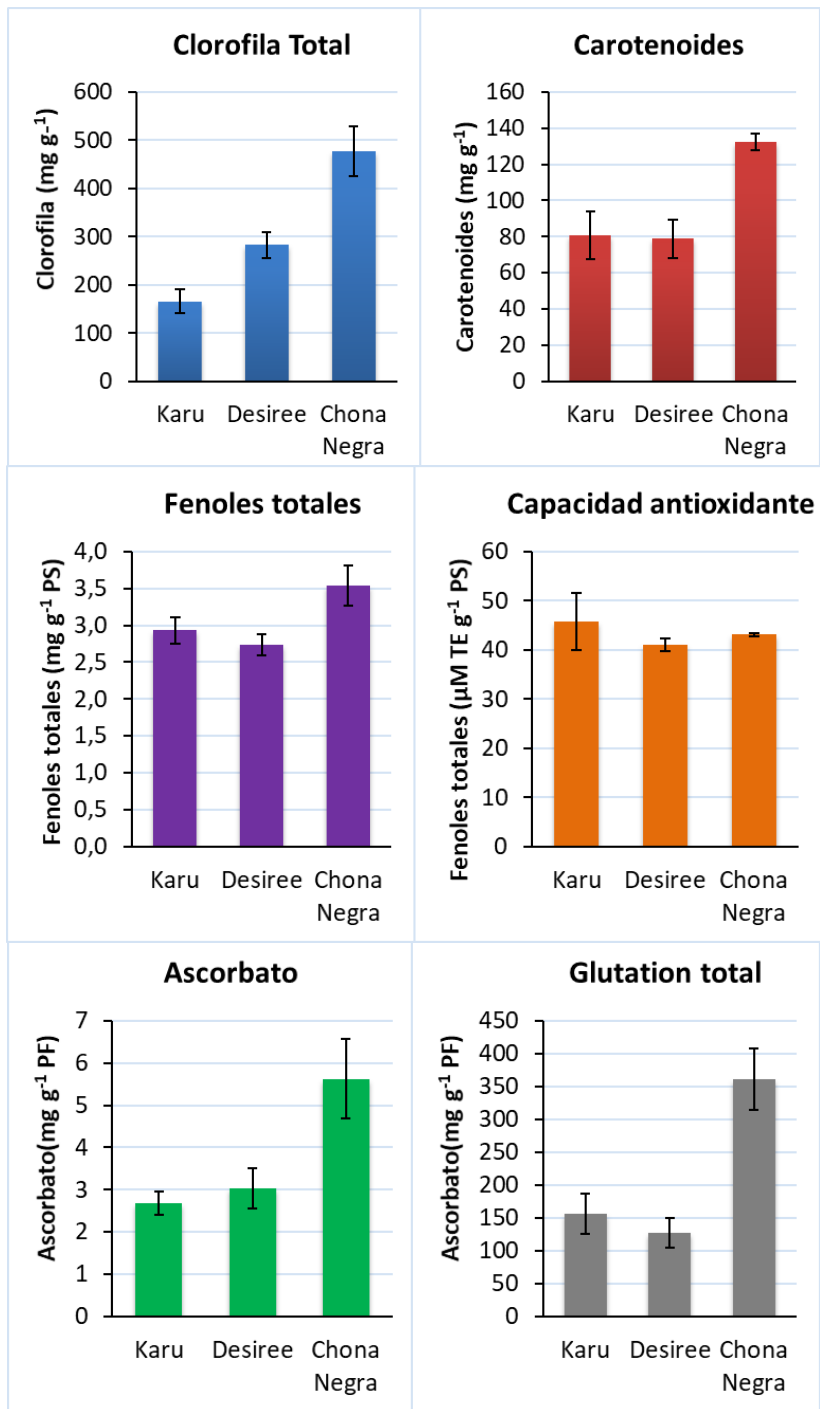


151%

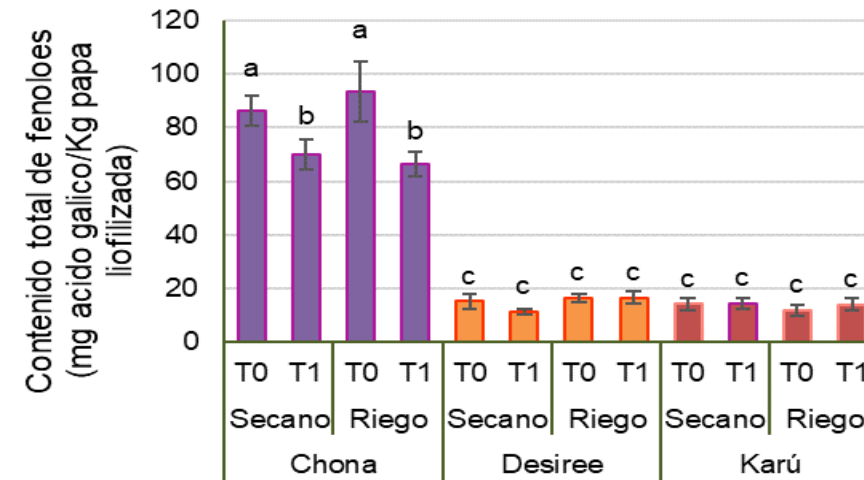
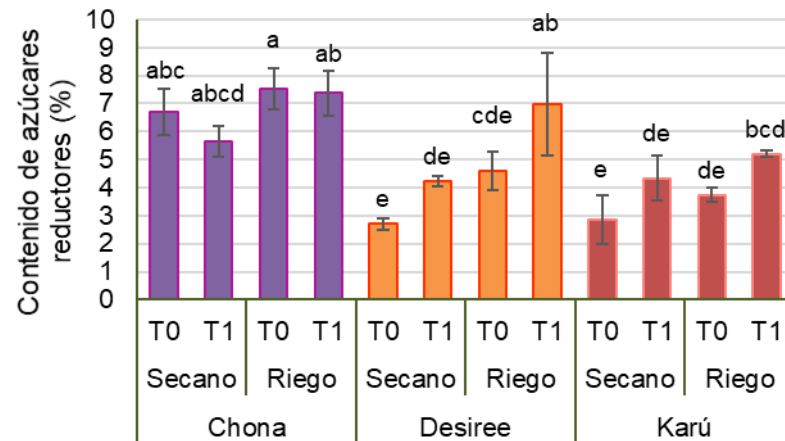
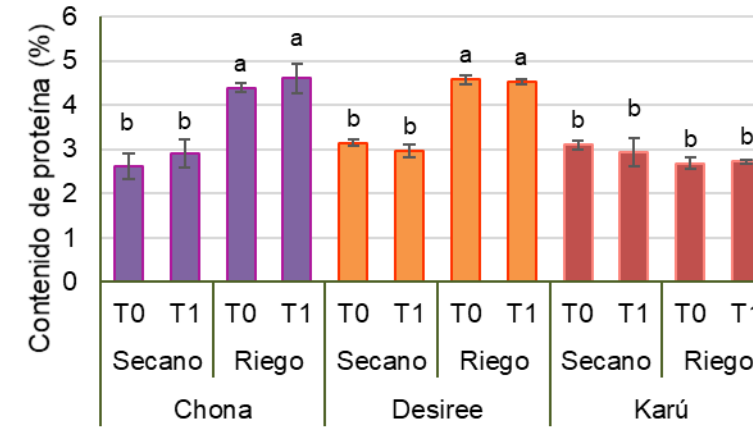
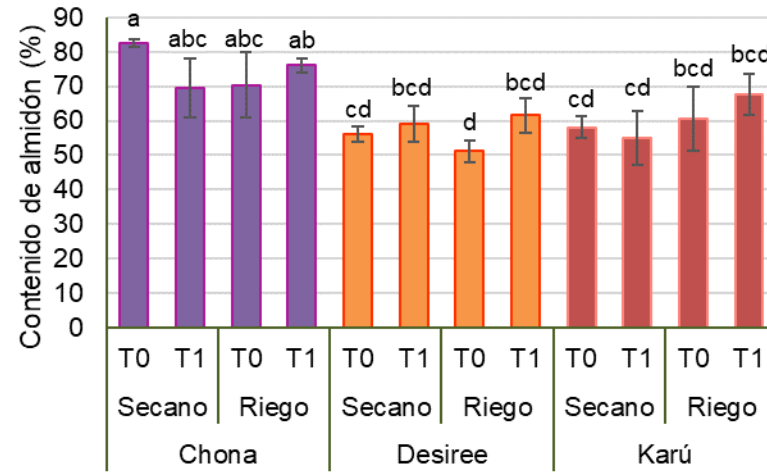
Aumento de prolina



Respuesta al estrés oxidativo



Composición del tubérculo de papa



Nuevas variedades de papa, mejoradas a partir de variedades nativas, que no existen actualmente en el mercado nacional.



Selección de líneas mejoradas proyecto FIA PYT 2018-0023

Año 1 (2018-2019)

Líneas mejoradas	1 M	18M
	3M	20M
	6M	21M
	7M	23M
	8M	24M
	9M	29M
	10M	30M
	12M	32M
	13M	33M
	15M	34M
	16M	35M
Variedades Nativas		
Chona Negra		
Cabrita		
Variedades comerciales		
Desiree		
Patagonia		

Localidad

Valdivia

Tratamientos

T° ambiente y Riego
T° ambiente y secoano
T° alta y riego
T° alta y secoano



Año 2 (2019-2020)

Líneas mejoradas seleccionadas	1 M	18M
	3M	
	6M	21M
	7M	
	8M	
	9M	29M
	10M	30M
	13M	33M
		35M
Variedades Nativas		
Chona Negra		
Cabrita		
Variedades comerciales		
Desiree		
Patagonia		

Localidad

Valdivia (riego y secoano)
Perquenco (riego)
Puerto Octay (secano)
Los muermos (secano)

Tratamientos

Valdivia:
Riego y secoano
N0 y N200
3 fechas de plantación



Año 3 (2020-2021)

Líneas mejoradas seleccionadas	1 M	
	3M	
		21M
	9M	29M
	10M	
		33M
		35M
Variedades Nativas		
Chona Negra		
Michuñe Negra		
Variedades comerciales		
Desiree		
Patagonia		

Localidad

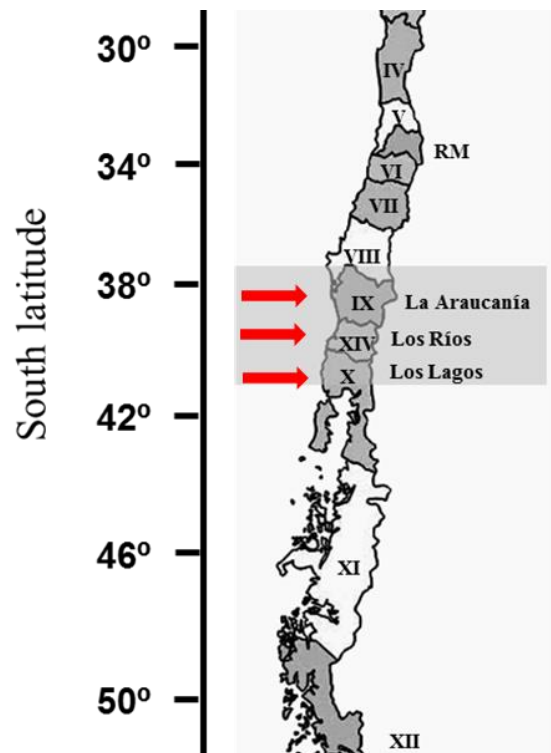
Valdivia (riego y secoano)
Perquenco (riego)
Puerto Octay (secano)

Tratamientos

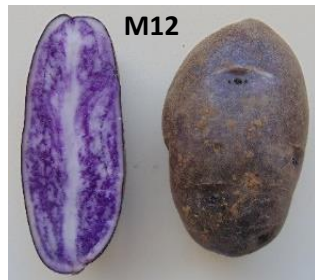
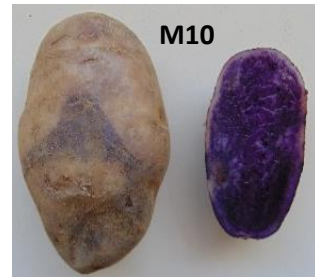
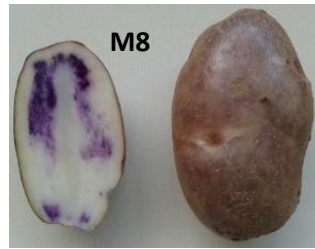
Valdivia:
Riego y secoano



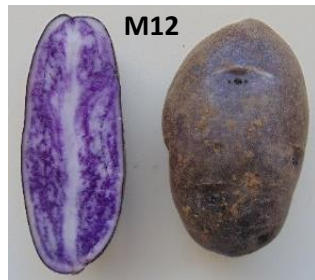
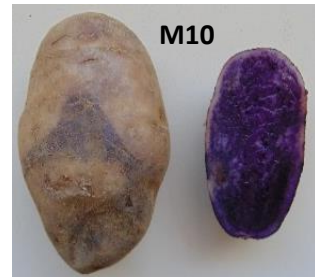
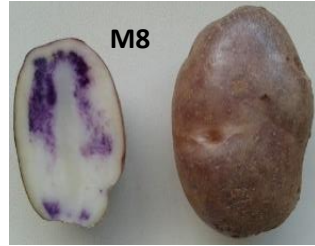
ENSAYOS REGIONALES



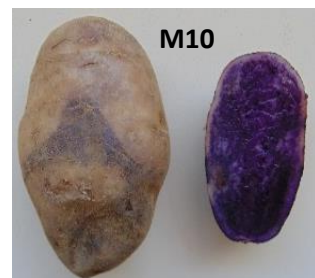
22 líneas mejoradas (2018-2019)



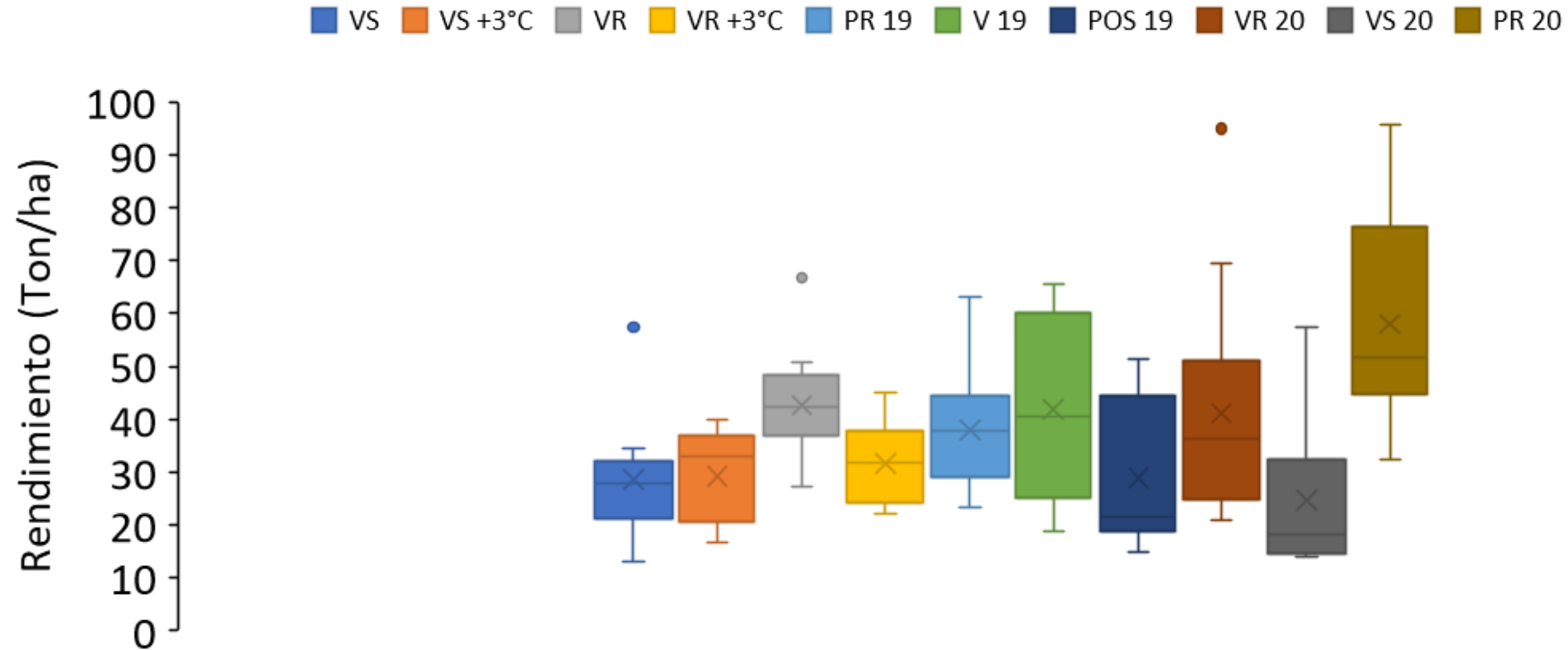
14 líneas mejoradas (2019-2020)



8 líneas mejoradas (2020-2021)

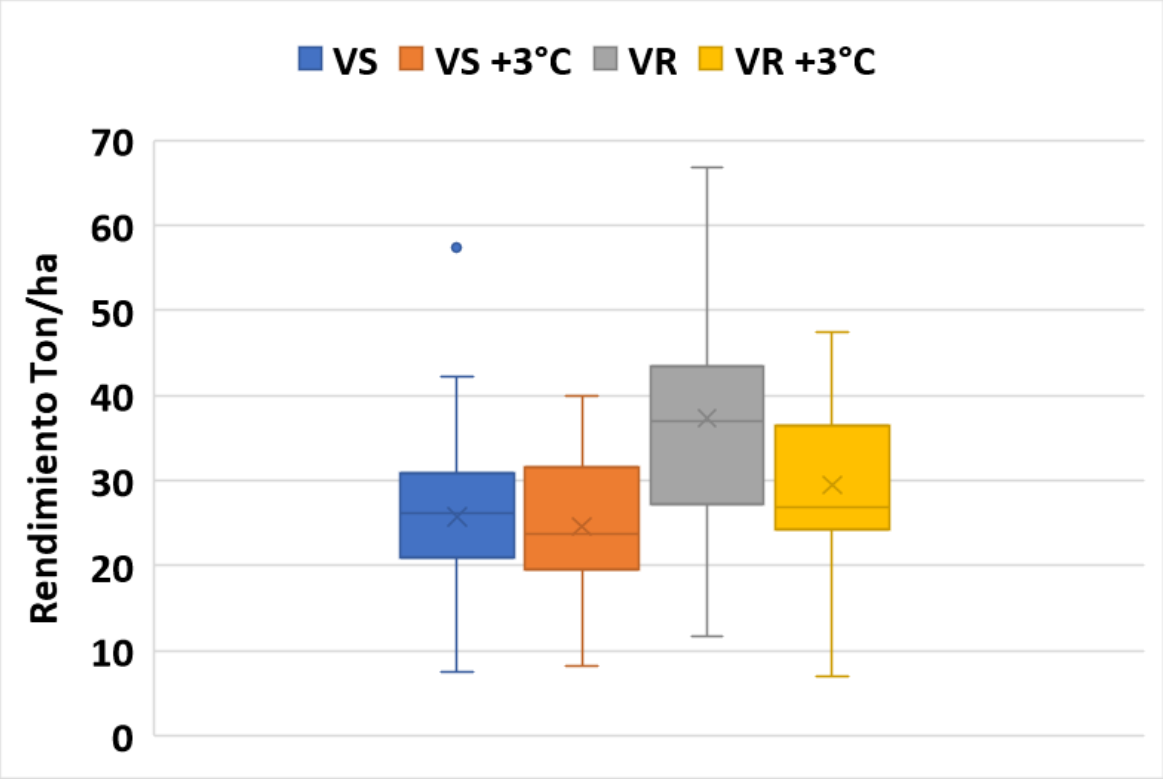


RENDIMIENTO 3 localidades, 3 temporadas, tratamientos térmicos y de disponibilidad hídrica

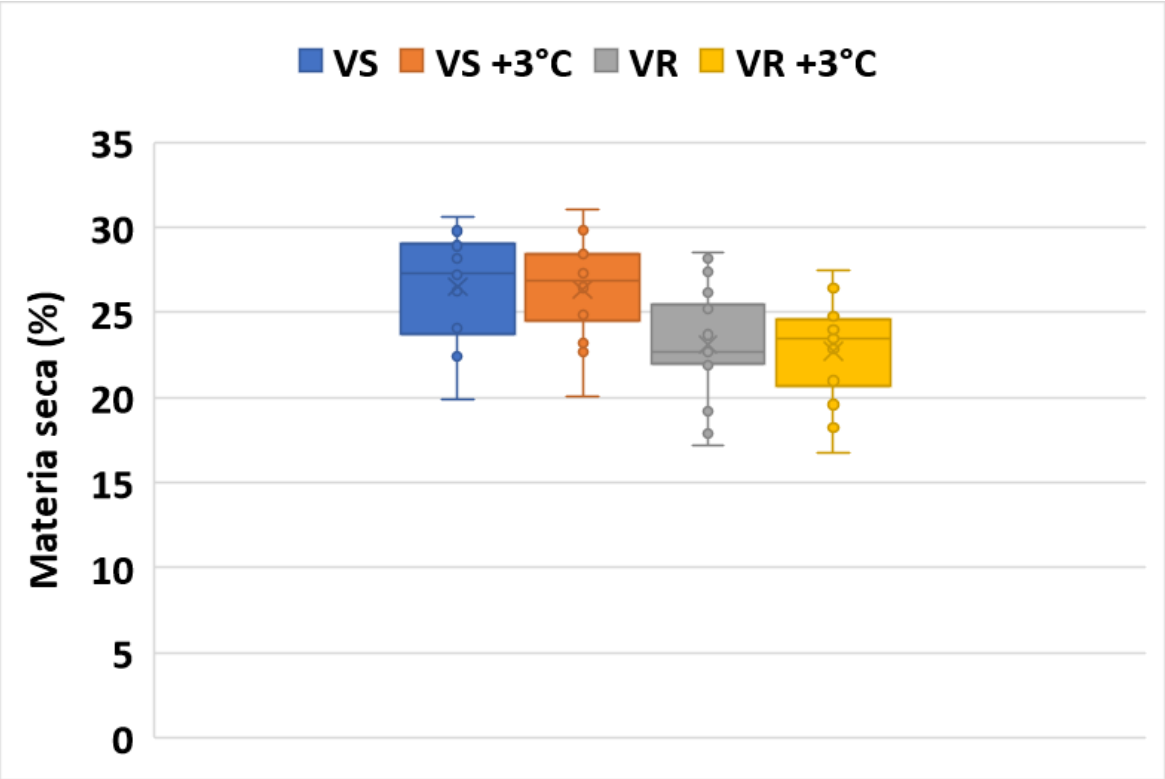


EFFECTO DE LA TEMPERATURA Y DISPONIBILIDAD HÍDRICA

RENDIMIENTO

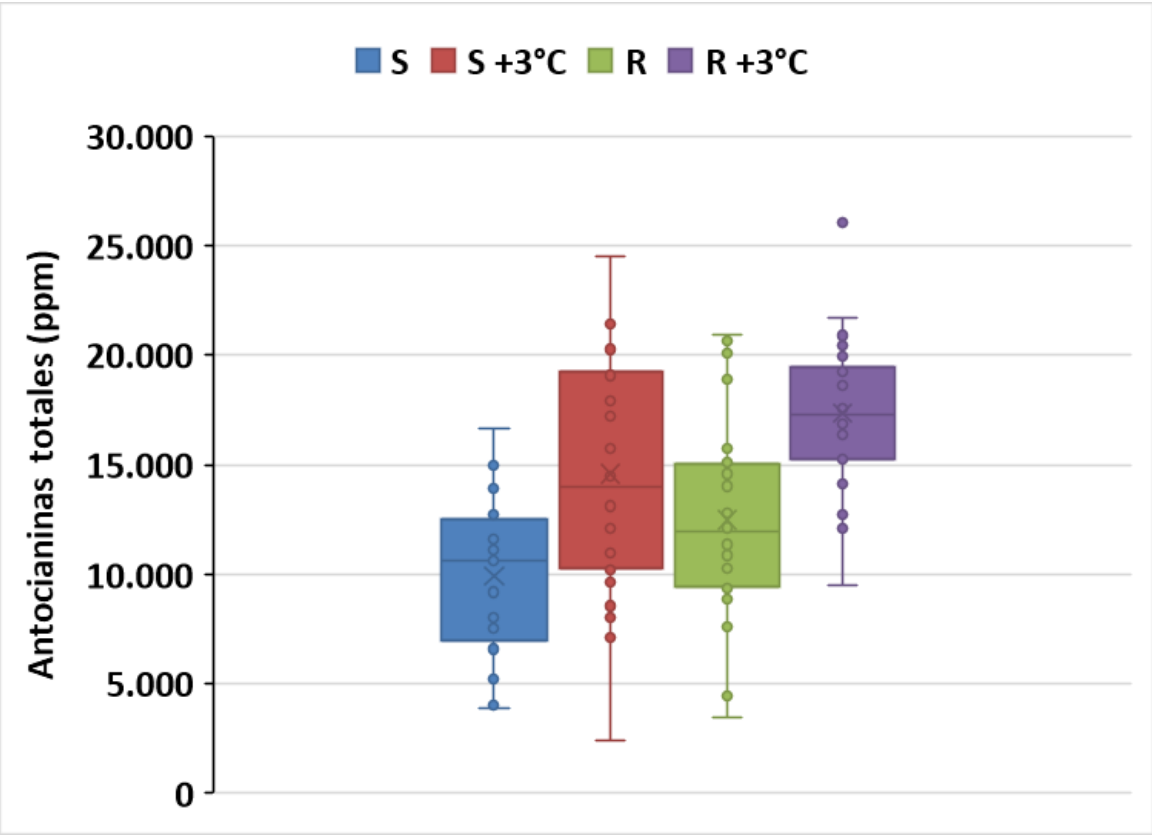


MATERIA SECA

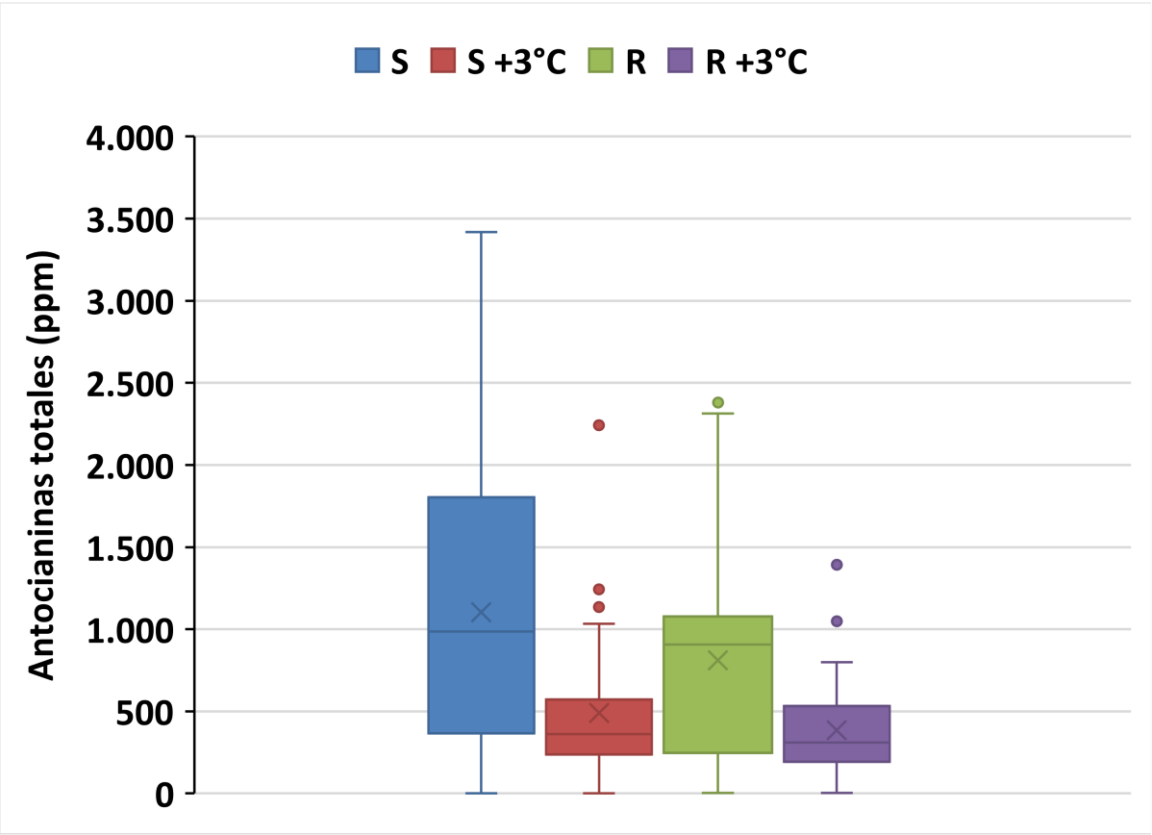


EFFECTO DE LA TEMPERATURA Y DISPONIBILIDAD HÍDRICA

FENOLES TOTALES

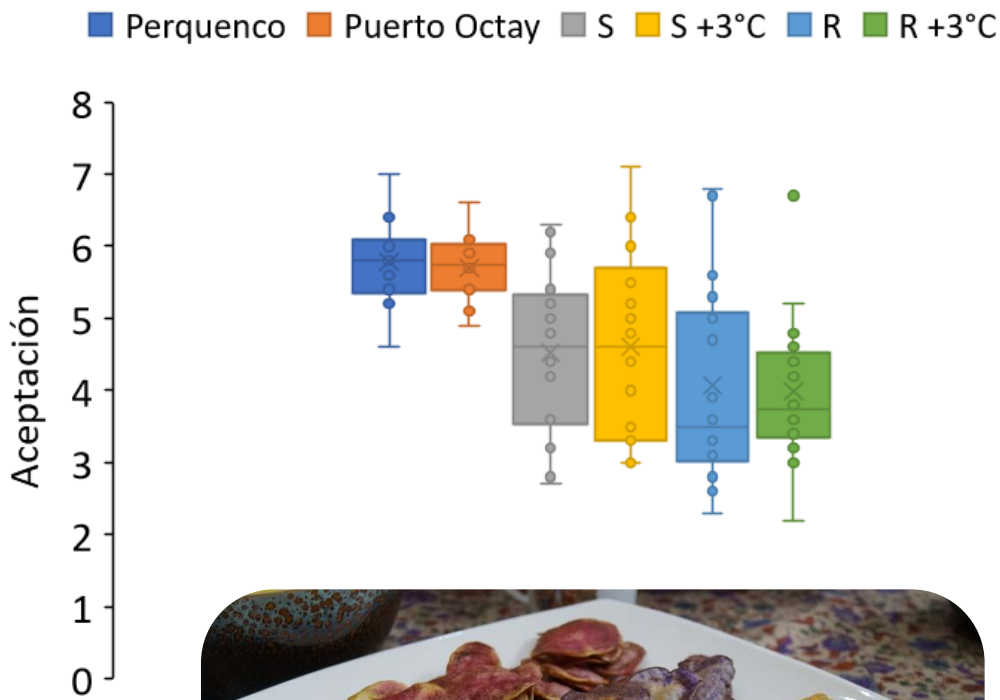


ANTOCIANINAS TOTALES



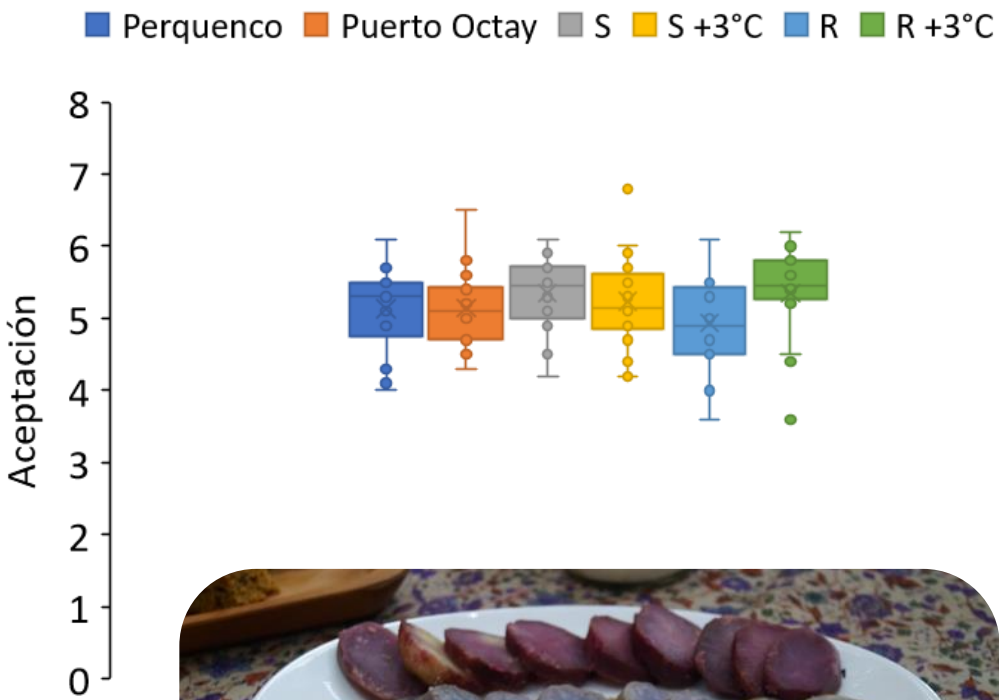
EFECTO DEL AMBIENTE EN LA ACEPTACIÓN DEL CONSUMIDOR

PAPAS FRITAS



- 1. Muy baja
- 2. Muy bajo a bajo
- 3. Bajo
- 4. Bajo a medio
- 5. Medio
- 6. Medio a alta
- 7. Alta
- 8. Alta a muy alta
- 9. Muy alta

PAPAS COCIDAS



CONCLUSIONES

Aumentos de temperatura de 2-3°C **no afectaran negativamente el rendimiento en papa** y podrían **aumentarlo en condiciones de riego** en condiciones templadas del sur de Chile.

Existe un efecto importante de GxE en la composición de los tubérculos y por lo tanto en su calidad nutricional y funcional.

Los genotipos nativos pueden ser una importante fuente de variación en tolerancia a estreses ambientales





IPSV
Instituto de Producción
y Sanidad Vegetal UACH



ALAP
Asociación Latinoamericana de la Papa

AGRADECIMIENTOS

*Andrea Avila
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*Fondecyt 11110500
DID S-2016-06
FIA PYT 2018-0023
Programa de cooperación
bilateral chile – federación
valonia-bruselas y región
valona de Bélgica*

