The use of Sulfur Dioxide and Controlled Atmospheres to Increase San Joaquin Valley Grown Blueberry Cultivars Market Life

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- Introduction & Objective
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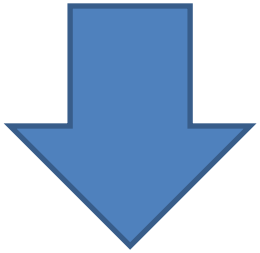
- Results
- Conclusions

Introduction

- Special category of **functional foods** because of their combination of nutrient richness & antioxidant strength
- Good source of **antioxidants**: prevention of several chronic diseases, coronary heart disease, stroke and certain types of cancer
- **Highly perishable**, susceptible to rapid spoilage and have a short market shelf life

Objective

- Extending the shelf life of fresh blueberries without a decrease in their postharvest quality, antioxidant and sensorial properties



Sulfur dioxide

Controlled atmospheres

Material & Methods

- 8 commercial cultivars

- **SO_2** fumigated (100 CT) or not
- 5 **storage atmospheres**
  - Control (air)
  - 3% CO2
  - 6% CO2
  - 12% CO2
  - 24% CO2

10 treatments
x 8 cultivars

Quality evaluation at harvest

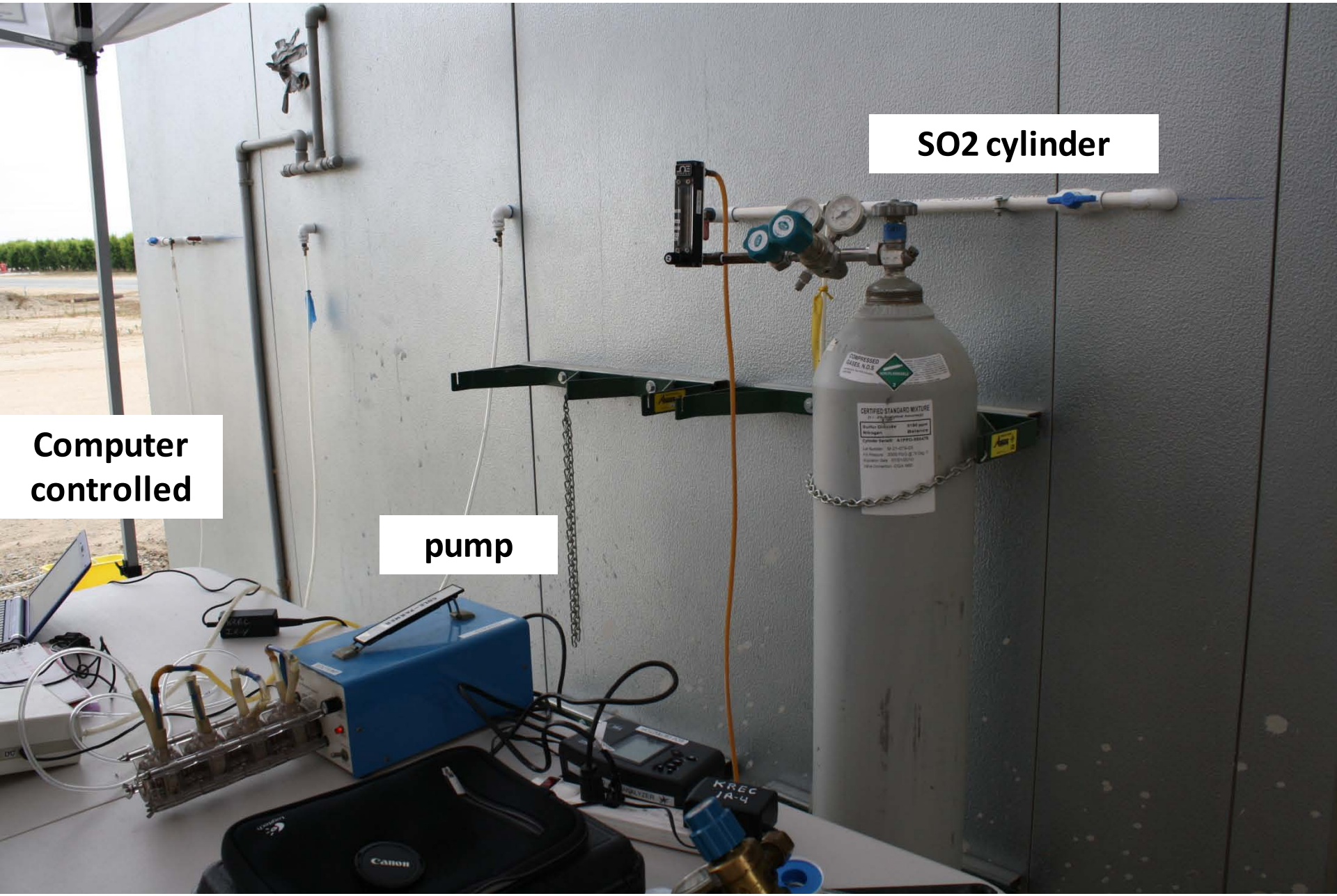
↓

SO2 fumigation


8 commercial cultivars
Vented plastic boxes
SNOW
100 CT
(3)

Place boxes on a sealed container

Place the sealed container in a cold room


SO2 cylinder
Computer controlled
pump
CERTIFIED STANDARD MIXTURE
KREC IA-4
Canon

Quality evaluation at harvest

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SO_2 fumigation

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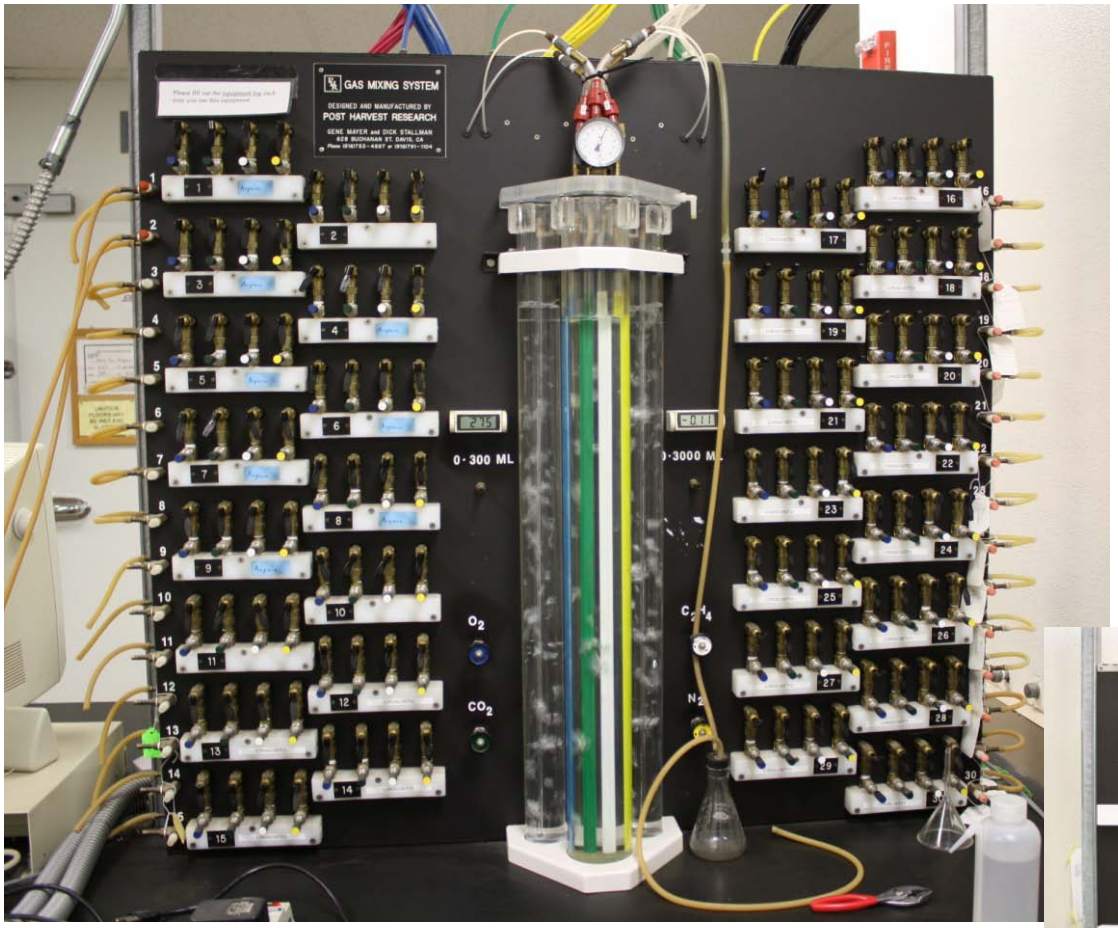
Storage at 1C in air or **controlled atmosphere**

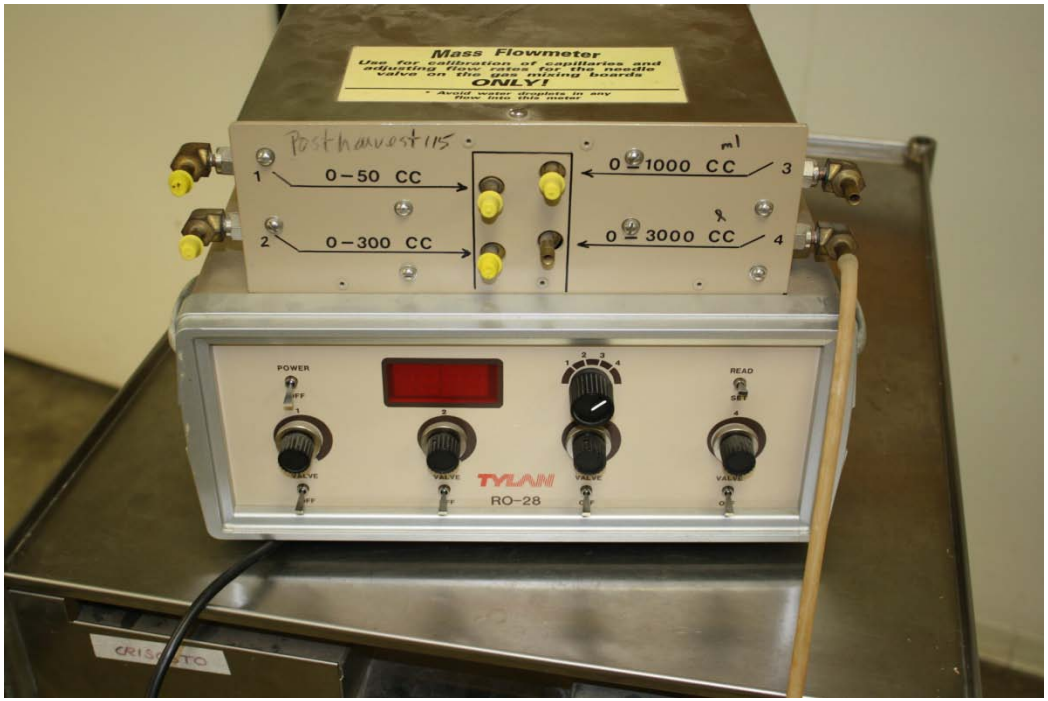
Mixing board

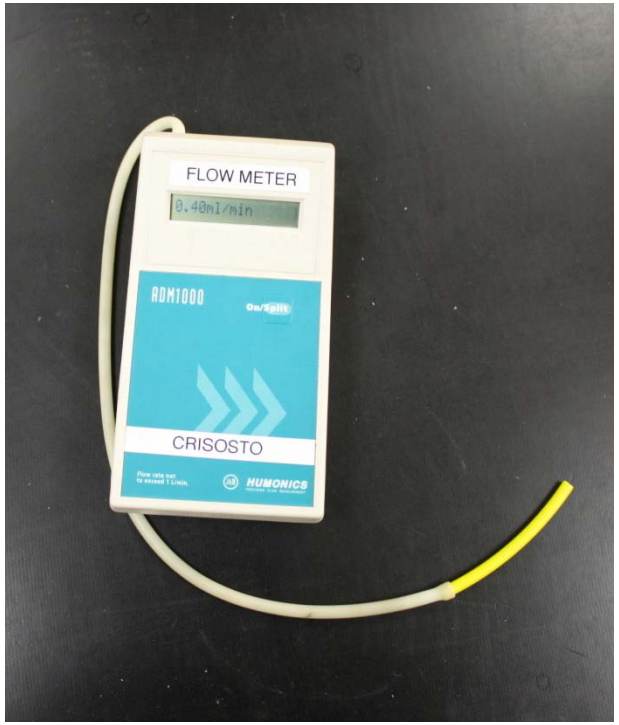


3% O2 +

3%, 6%, 12% and 24% CO2

Flow meter





Change the atmosphere every 8h

Quality evaluation at harvest

↓

SO_2 fumigation

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Storage at 1C in air or controlled atmosphere

↓

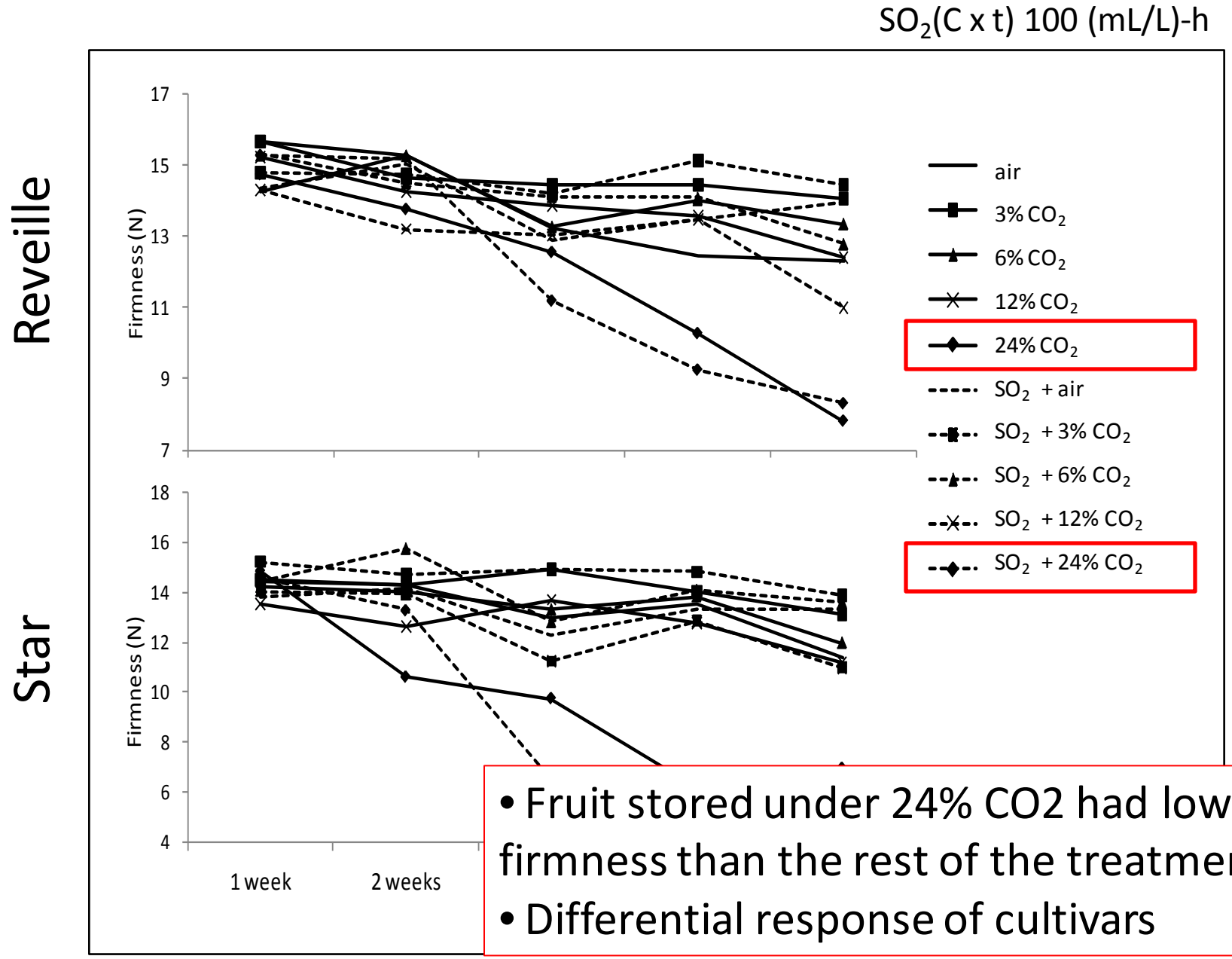
Fruit quality evaluation

Quality evaluation after 1, 2, 3, 4 and 5 weeks of cold storage

- Firmness
- SSC
- Titratable acidity
- Weight loss
- Shriveling
- Decay (%)
- Pathogens identification
- Off flavors (sensory evaluation)

Results

Firmness

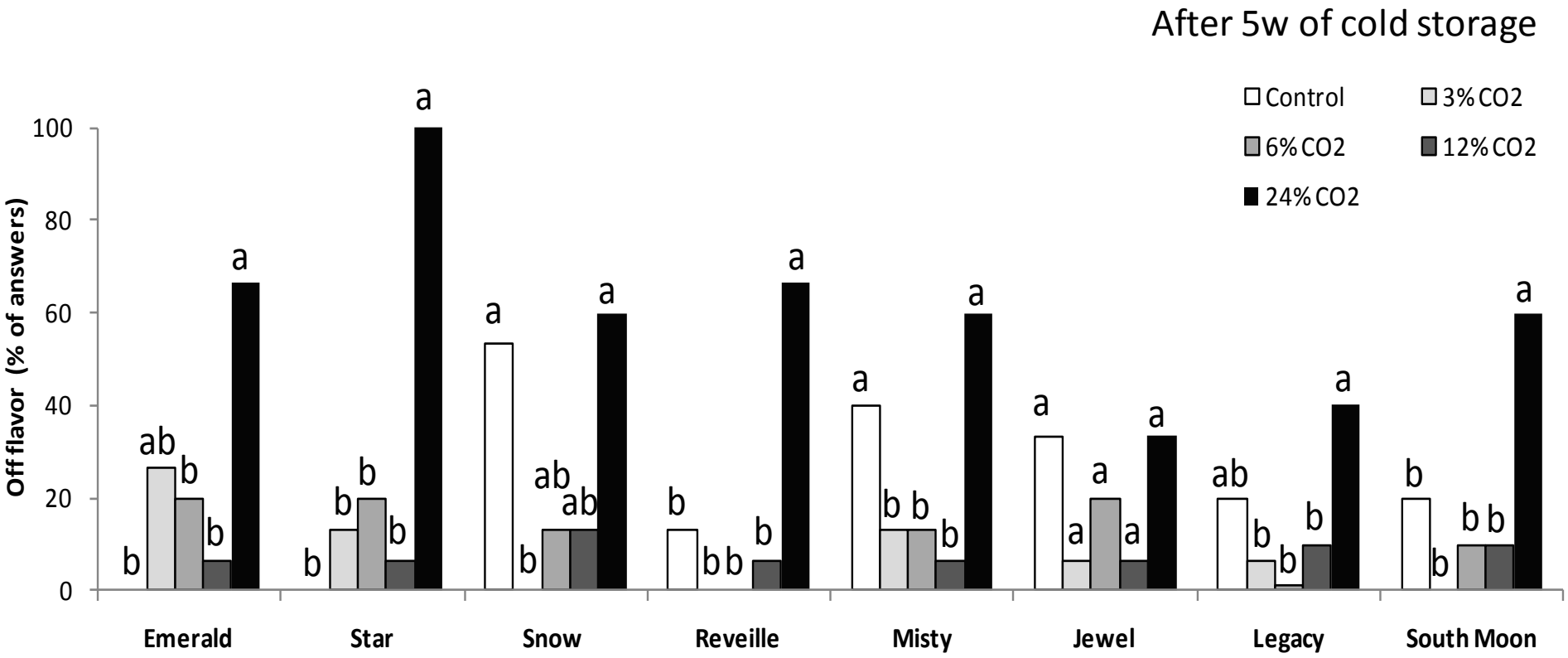


- Fruit stored under 24% CO2 had lower firmness than the rest of the treatments
- Differential response of cultivars

SSC and TA

- No significant effect of treatment was found for SSC and TA
- A slight increase in pH was found under CA

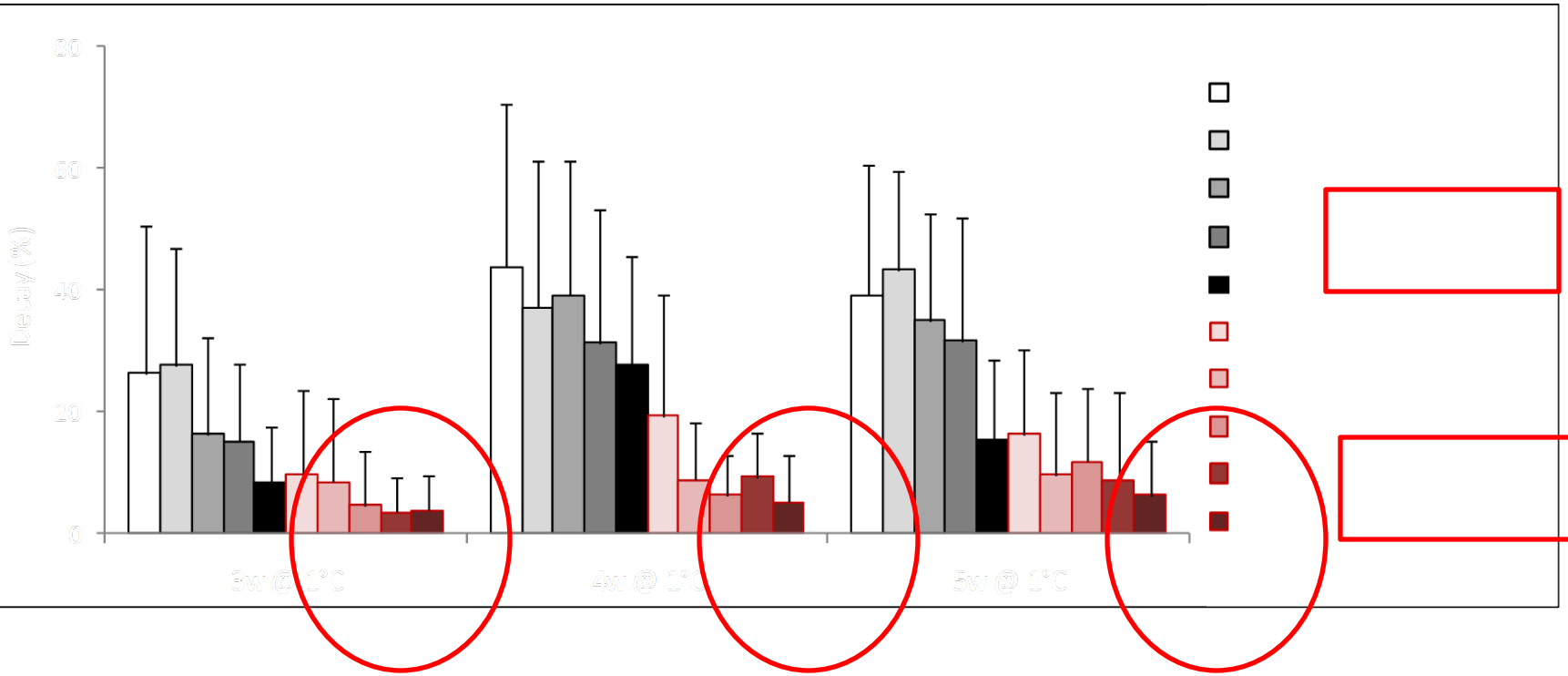
‘Off flavor’



24% CO_2 atmospheres

induced the formation of off flavors in the fruit

Decay (%)



A combination of SO_2 with high CO2 CA during storage was the best treatment to control decay

Reveille after 5w cold storage + 3d shelf life

Air (control) | 3% CO_2 | 6% CO_2

SO_2 100 (µL/L)h + air | SO_2 100 (µL/L)h + 3% CO_2 | SO_2 100 (µL/L)h + 6% CO_2

Reveille

Air

Air + SO2

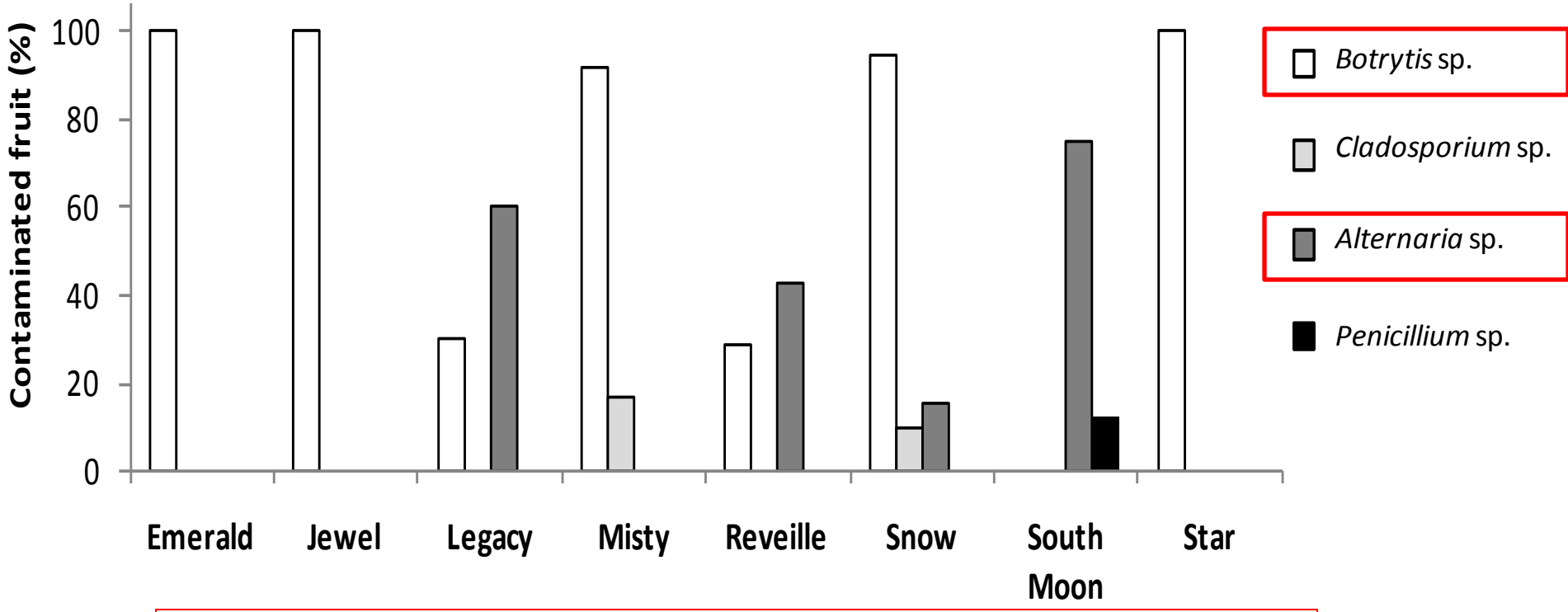
Snow after 5w cold storage + 3d shelf life

Air (control) | 3% CO2 | 6% CO_2 | 12% CO_2

SO_2 100 (mL/L)h + air | SO_2 100 (mL/L)h + 3% CO_2 | SO_2 100 (mL/L)h + 6% CO_2 | SO_2 100 (mL/L)h + 12% CO_2

Pathogens

after 5w at 1°C + 3d at 20°C



When isolation was performed in the interior of the berries, *B. cinerea* and *Aureobasidium pullulans* were the most common pathogens

Antioxidants

Treatment			TPC (mg GA/ 100 g FW)		THA (µg caffeic acid/ 100 g FW)		TF (mg rutin/ 100 g FW)		TA (mg cyanidin/ 100 g FW)		FRAP (mmol AsA/ 100 g FW)	
After 1w at 1°C												
	air		145.25	ab	138.1	ab	35.6	a	88.0	a	70.5	ab
	6 % CO_2		136.9	bc	126.6	bc	34.5	ab	70.0	ab	71.3	ab
	12 % CO_2		124.4	c	119.5	c	29.9	b	65.9	b	64.9	b
	SO_2 100 (µL/L) h +	6 % CO_2	133.8	bc	127.3	bc	31.6	ab	68.7	ab	69.7	ab
	SO_2 100 (µL/L) h +	12 % CO_2	153.4	a	148.1	a	36.6	a	79.6	ab	78.6	a
After 3w at 1°C												
	air		165.7	a	157.2	a	38.3	a	68.3	a	89.5	a
	6 % CO_2		162.7	a	166.0	a	39.5	a	97.2	a	88.9	a
	12 % CO_2		175.8	a	168.4	a	40.8	a	101.1	a	92.5	a
	SO_2 100 (µL/L) h +	6 % CO										
	SO_2 100 (µL/L) h +	12 % C										
After 5w at 1°C												
	air											
	6 % CO_2											
	12 % CO_2		150.3	a	140.4	b	32.4	b	73.4	a	78.1	b
	SO_2 100 (µL/L) h +	6 % CO_2	154.9	a	174.4	a	34.5	b	93.9	a	100.4	a
	SO_2 100 (µL/L) h +	12 % CO_2	156.7	a	142.2	b	38.6	ab	83.4	a	90.1	ab

No consistent differences were observed between treatments on the antioxidant properties of any cultivar studied

Conclusions

- **6%** and **12%** CO2 were the best CA treatments to reduce decay and increase the shelf life of fresh blueberries
- The combination with **SO_2** improved the effect of CA
- very high levels of CO_2 (24%) should be avoided to prevent **softening** and/or '**off-flavors**'
- CA + SO_2 reduced the growth of **pathogens**
- **no negative effects** of SO_2 + CA were observed on the **berry quality** and **phytochemical content**

Thanks to…

- Manuel Jimenez
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Questions?