


VAN CA technology
AMERONGEN

气调贮藏实验设备


AGRICULTURE VICTORIA

EastPack
Growers at heart

 PRAKTIJKONDERZOEK
PLANT & OMGEVING
WAGENINGEN UR

InHort
SKIERNIEWICE

 WAGENINGEN
UNIVERSITY & RESEARCH


ExperiCo
Agri-Research Solutions


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1982
ANTALYA

气调实验如何 让您在生产中 受益？

水果贮藏实验的目的是了解水果在贮藏和货架期的采后行为表现。

高价值水果商业贮藏利润丰厚，但采后问题造成的损失也不容忽视。

开展水果气调研究有助于发现商业贮藏中的品质损失问题。实验中产生的数据可用于实际应用，更新升级水果的贮藏条件，逐步完善贮藏方案，使您的实际收益最大化。

气调贮藏实验设备选项

可开展各层级的研究

VAN CA technology
AMERONGEN



帐式大容量单元



多重柜式单元



箱式实验单元



气调测试室



帐式小容量单元

帐式大容量单元

使用客户：
EastPack 新西兰

为什么选择帐式大容量单元？

- 大容积：
800kg水果/单元
- 动态气调ACR系统可用
- 通过取样袖套轻松进行
贮藏期果品检测



所需组件

- 帐式大容量单元&取样袖套
- “我的水果”控制软件
- 氮气注入系统
- 二氧化碳注入/脱除系统
- 乙烯脱除系统
- 氧气注入系统
- 温度监控
- 相对湿度监控
- 数字气压测量



帐式大容量单元&水果取样袖套



“我的水果”控制柜&触屏



氮气注入系统



二氧化碳&乙烯脱除



温度&相对湿度&气压监控

提供实验计划指导

week	treatment	Week 1							Week 2							Week 3						
Day		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Factors		Fruits size														CA-no ethy.	CA+ethylene removal					
Actions	Orchard		Curing (if it is beneficial)						Pre-cooling (to ~0 degree)							Start ACR with standard CA						
Cover 1	CA storage	Orchrd1&2	M	Curing					Pre-cooling							CA-no ethylene removal						
		Orchrd1&2	L	Curing					Pre-cooling							CA-no ethylene removal						
Cover 2	CA storage	Orchrd1&2	M	Curing					Pre-cooling							CA+ethylene removal						
		Orchrd1&2	L	Curing					Pre-cooling							CA+ethylene removal						
Cover 3	ACR slow	Orchrd1&2	M	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 4	ACR Quick	Orchrd1&2	L	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 5	ACR slow	Orchrd1&2	M	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 6	ACR Quick	Orchrd1&2	L	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 7	ACR slow	Orchrd1&2	M	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 8	ACR Quick	Orchrd1&2	L	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 9	ACR slow	Orchrd1&2	M	Curing					Pre-cooling							Standard CA (2% O2)						
Cover 10	ACR Quick	Orchrd1&2	L	Curing					Pre-cooling							Standard CA (2% O2)						

week	Week 4							Week 5							Week 6						
Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Factors	ACR slow(33 days)+ethylene removal	ACR quick(21days)+ethylene removal																			
Actions	storage																				
Cover 1	storage																				
Cover 2	storage																				
	storage																				
Cover 3	ACR slow(33 days)-no ethylene removal	1,8% O2				1,6% O2		1,4% O2			1,2% O2			1,1% O2			1,0% O2			0,9% O2	
Cover 4	ACR quick(21days)-no ethylene removal	1,7% O2				1,4% O2		1,1% O2			0,8% O2			0,7% O2			0,6% O2			0,5% O2	
Cover 5	ACR slow(33days)+ethylene removal	1,8% O2				1,6% O2		1,4% O2			1,2% O2			1,1% O2			1,0% O2			0,9% O2	
Cover 6	ACR quick(21days)+ethylene removal	1,7% O2				1,4% O2		1,1% O2			0,8% O2			0,7% O2			0,6% O2			0,5% O2	
Cover 7	ACR slow(33 days)-no ethylene removal	1,8% O2				1,6% O2		1,4% O2			1,2% O2			1,1% O2			1,0% O2			0,9% O2	
Cover 8	ACR quick(21days)-no ethylene removal	1,7% O2				1,4% O2		1,1% O2			0,8% O2			0,7% O2			0,6% O2			0,5% O2	
Cover 9	ACR slow(33days)+ethylene removal	1,8% O2				1,6% O2		1,4% O2			1,2% O2			1,1% O2			1,0% O2			0,9% O2	
Cover 10	ACR quick(21days)+ethylene removal	1,7% O2				1,4% O2		1,1% O2			0,8% O2			0,7% O2			0,6% O2			0,5% O2	

week	Week 7							Week 8							Shelf life Week						
Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Factors																					
Actions																					
Cover 1															Shelf condition						
															Shelf condition						
Cover 2															Shelf condition						
															Shelf condition						
Cover 3			0,8% O2			0,7% O2		0,6% O2		0,5% O2			storage		Shelf condition						
Cover 4	storage														Shelf condition						
Cover 5			0,8% O2			0,7% O2		0,6% O2		0,5% O2			storage		Shelf condition						
Cover 6	storage														Shelf condition						
Cover 7			0,8% O2			0,7% O2		0,6% O2		0,5% O2			storage		Shelf condition						
Cover 8	storage														Shelf condition						
Cover 9			0,8% O2			0,7% O2		0,6% O2		0,5% O2			storage		Shelf condition						
Cover 10	storage														Shelf condition						

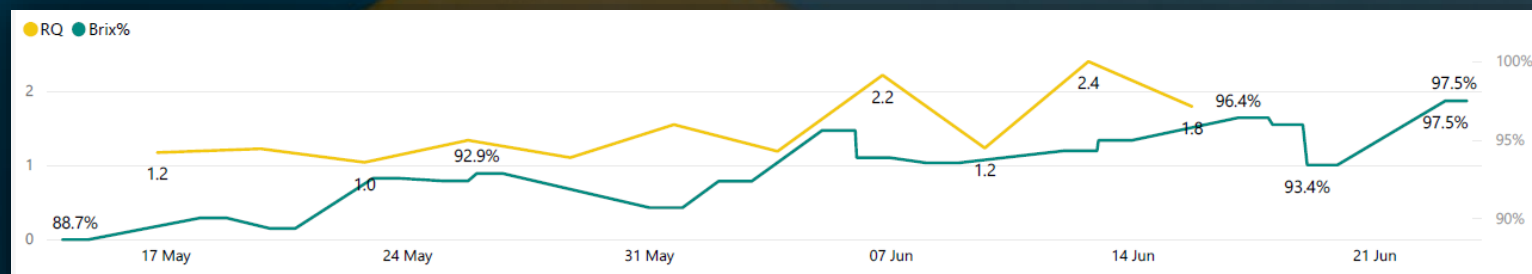
End of quick ACR realisation

End of slow ACR realisation

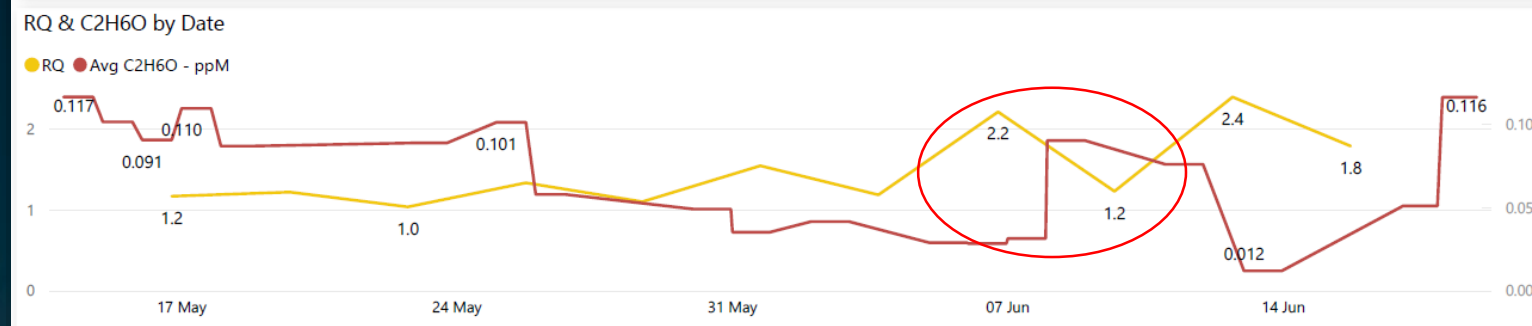
测试期间数据记录

保持与客户互动

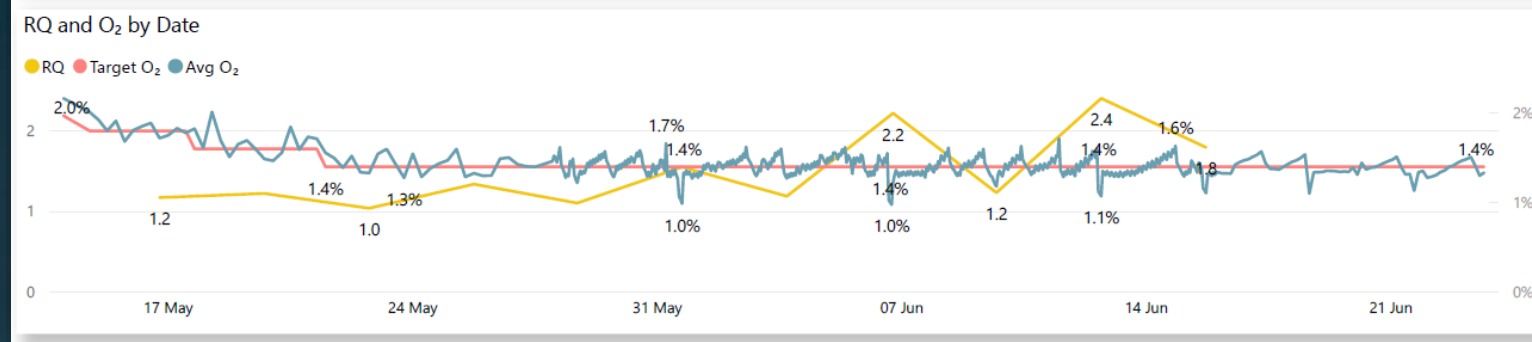
呼吸商 & 含糖量



呼吸商 & 乙醇产生量



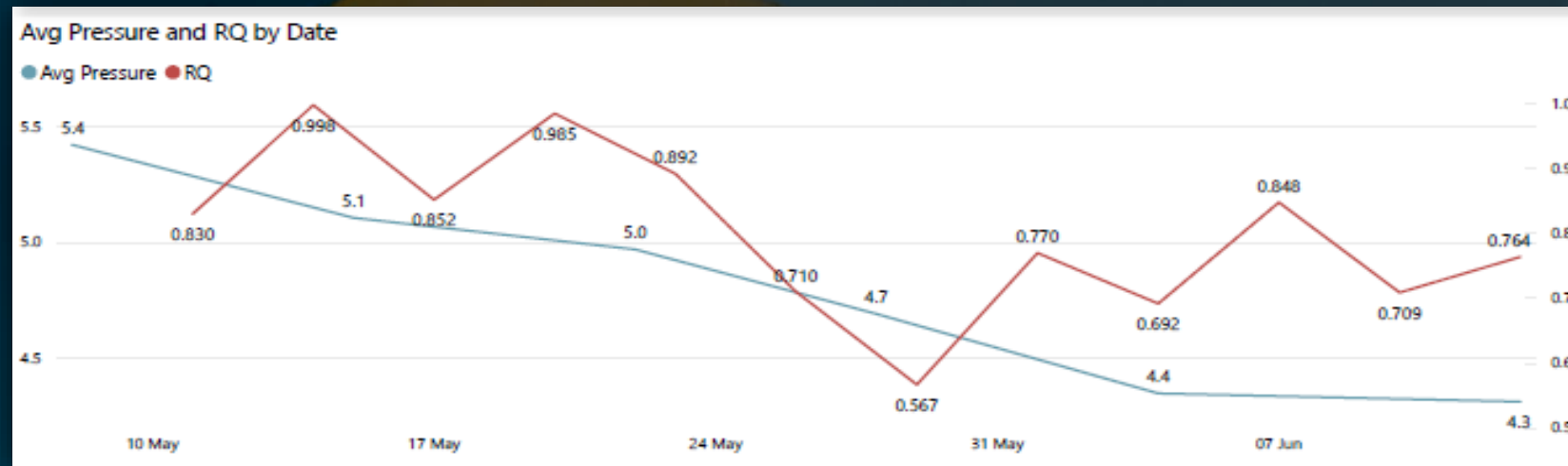
呼吸商 & 氧气浓度



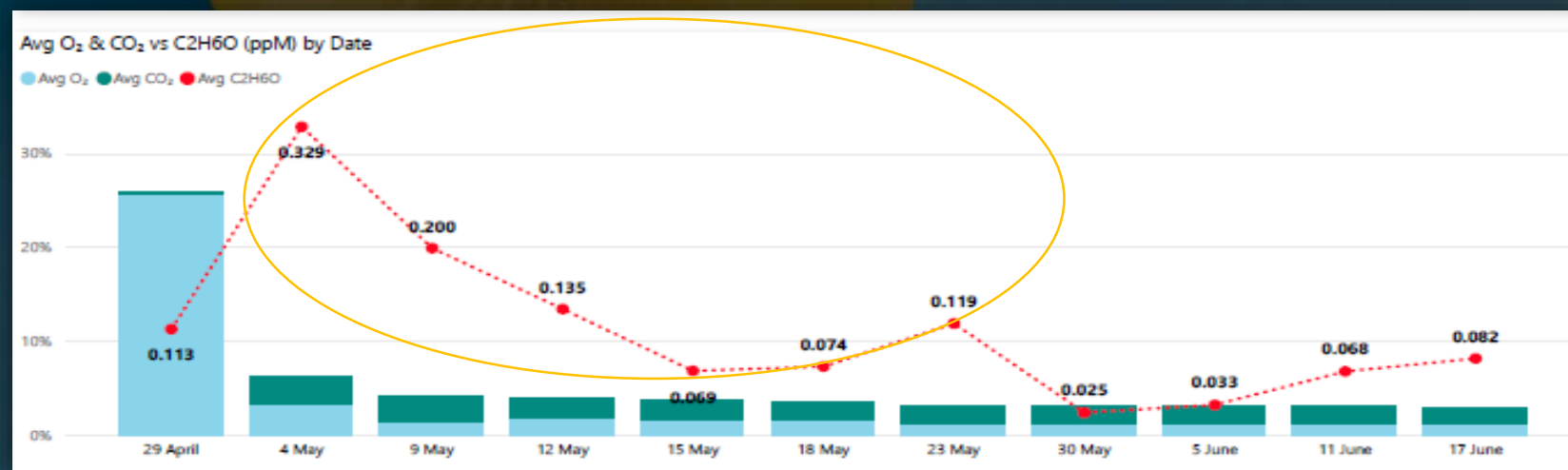
测试期间数据记录

保持与客户互动

硬度 & 呼吸商



氧气 & 二氧化碳浓度
vs 乙醇产生量



多重柜式单元

- 1-2 m³ 容积：100-200kg水果/单元
- 由技术人员和水果专家操作
- 精确的空气循环
- 各单元独立温度、相对湿度控制
- 乙二醇冷却系统
- 小型商业房间模拟



八个带有独立制冷的实验单元



使用客户：

气调测试室



气调室内部



气调室



失水测量仪



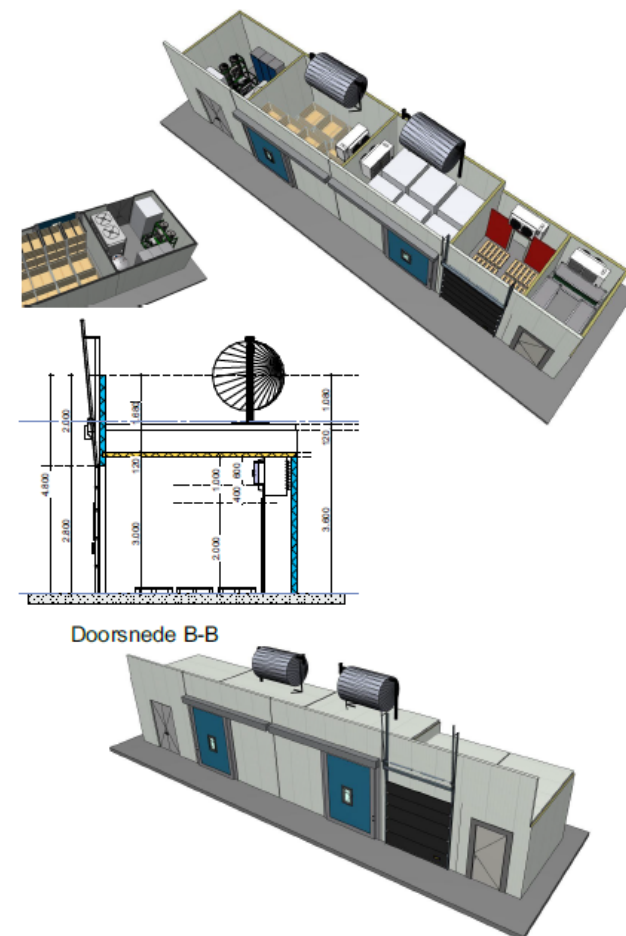
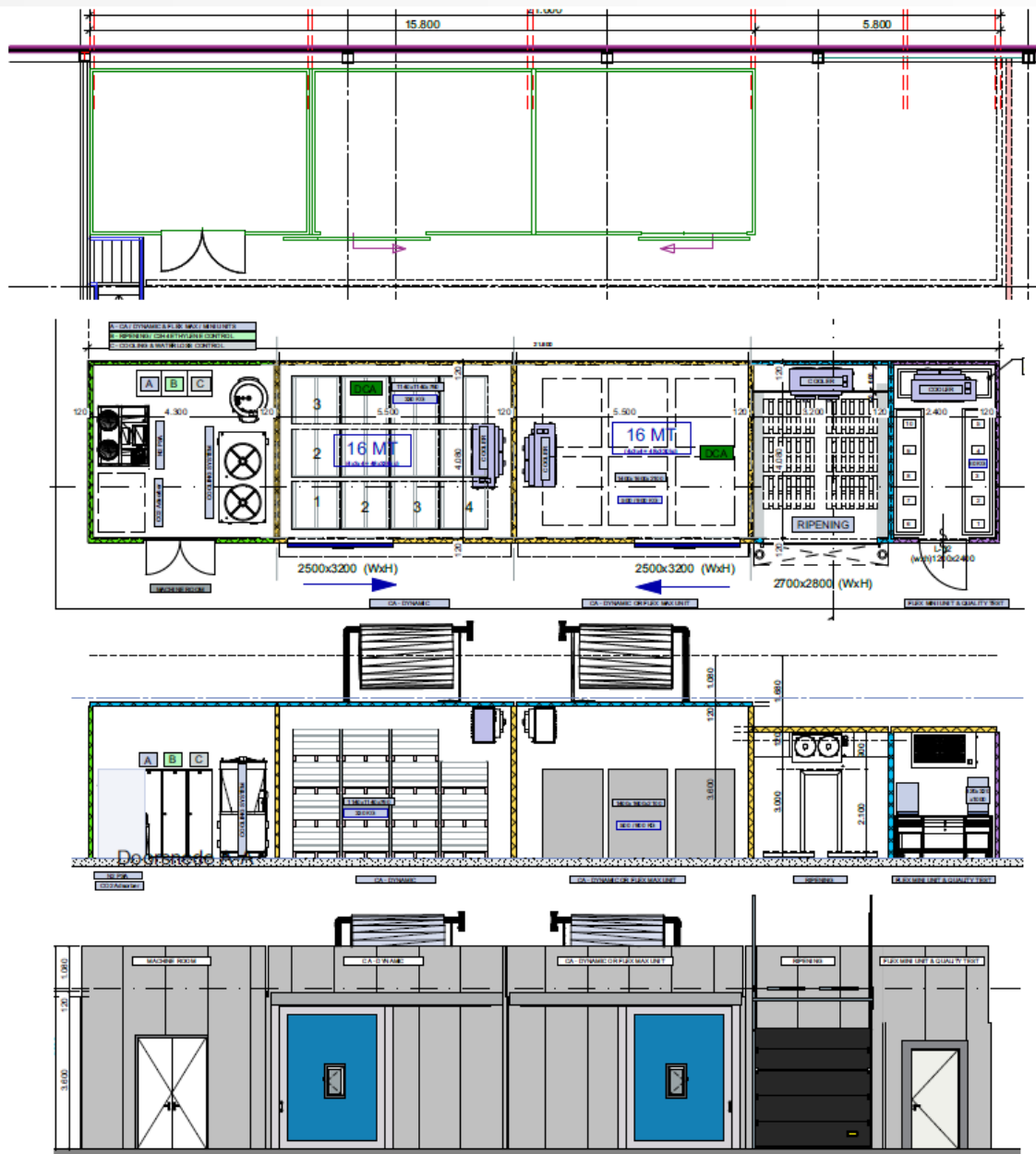
- 终身使用水果研究设施
- 量身定制的研究中心
- 由技术人员和水果专家操作
- 多功能：
 - 冷却室
 - 气调室
 - 催熟&褪绿室
 - 货架期室

使用客户：

研发中心 设计图纸

使用客户:

VAN CA technology
AMERONGEN



#Project Name Van Amerongen		Datum 01-03-2021 22-03-2021
Onderdeel CA + RIPENING + R&D		
Projectnummer Nr. project	Schaal 1:100	A3-V105

移动气调实验站项目

始于1999 - 2022仍然活跃

VAN CA technology
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内置箱式气调单元

项目目的:

- 测试当地水果在气调条件下的基本耐贮性
- 与农业大学和潜在客户合作，促进投资
- 气调贮藏与技术操作基础知识转移



箱式实验单元

- 1 m³ 容积：150-200kg水果/单元
- 由技术人员和水果专家操作
- 精确的空气循环
- 中央冷却系统
- 独立控制：
 - 相对湿度
 - 压力
 - 氧气&二氧化碳&乙烯
 - 呼吸作用（动态气调ACR）

使用客户：



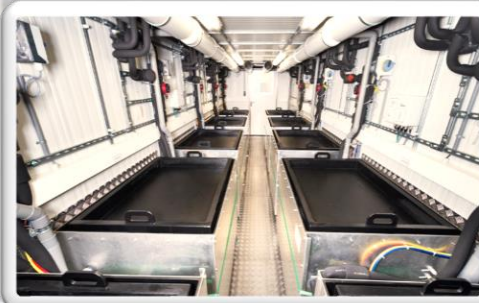
部分代表案例展示

□ 箱式实验单元

WFBR 瓦赫宁根大学研究中心
斯泰伦博斯大学
ExperiCo 园艺研究所
广西平南县农文旅
Tatura 维多利亚农业研究所
InHort 英霍尔特园艺研究所

位置

荷兰
南非
南非
中国
澳大利亚
波兰



测试产品:

苹果、梨、猕猴桃、芒果、石榴、
甜瓜、樱桃、蓝莓、蔬菜等

□ 帐式小容量单元

费萨拉巴德大学
塔尔卡大学
阿克德尼兹大学

位置

巴基斯坦
智利
土耳其

测试产品:

苹果、芒果、柑橘、香蕉、石榴、
番茄、无花果等



部分代表案例展示

□ 多重柜式单元

费萨拉巴德大学
塔尔卡大学
阿克德尼兹大学
PPO 瓦赫宁根研究中心

位置

巴基斯坦
智利
土耳其
荷兰

测试产品:

苹果、芒果、柑橘、香蕉、
石榴等



□ 帐式大容量单元

Eastpack 采后中心
Van Amerongen
ExperiCo 园艺研究所

位置

新西兰
荷兰
南非

测试产品:

阳光金果猕猴桃, 苹果等



□ 气调测试室

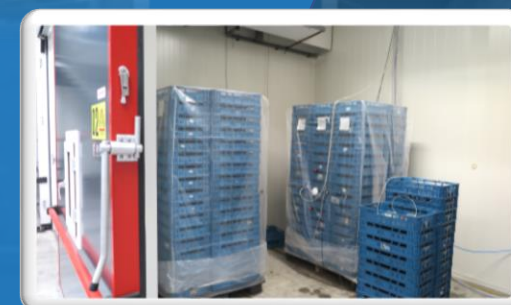
瓦赫宁根 PPO研究中心
Van Amerongen

位置

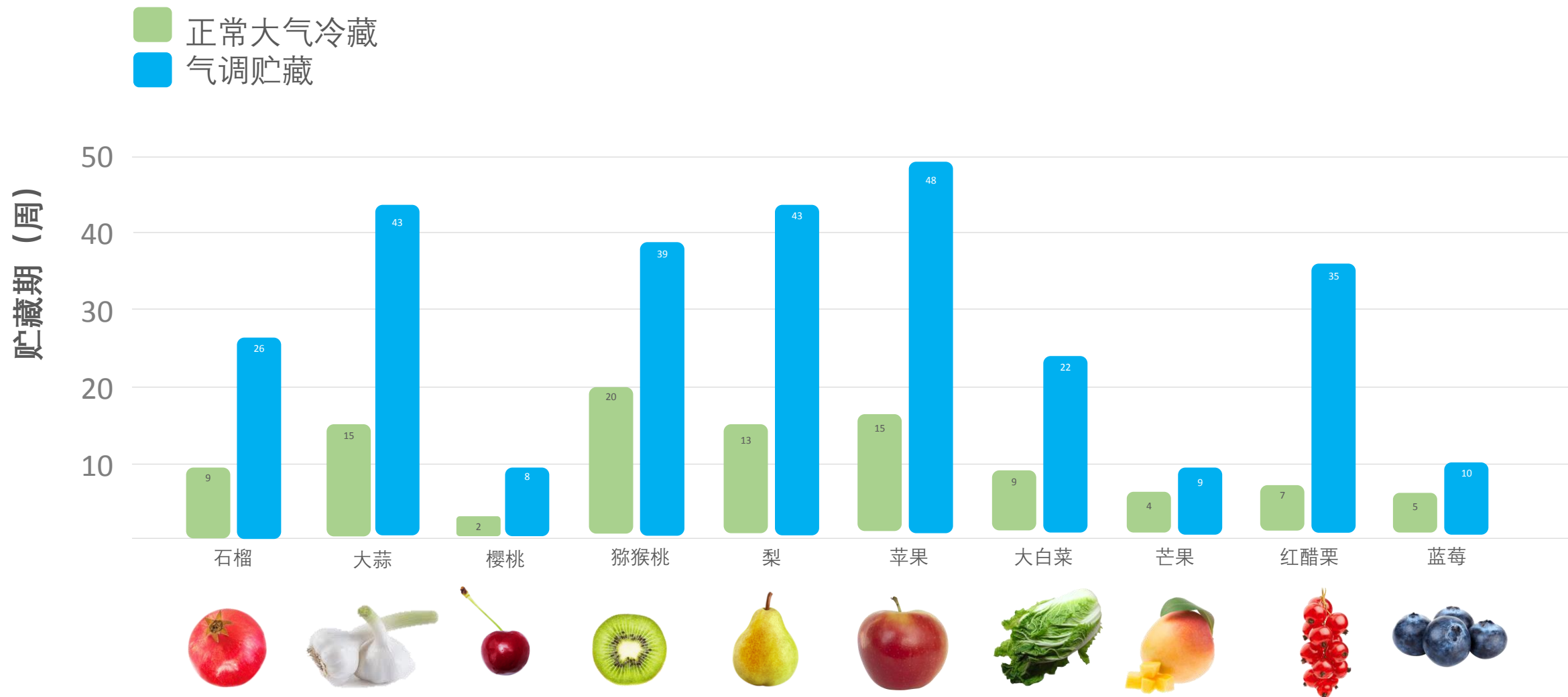
荷兰
荷兰

测试产品:

蓝莓、苹果、梨、樱桃、猕
猴桃等



气调贮藏效果展示



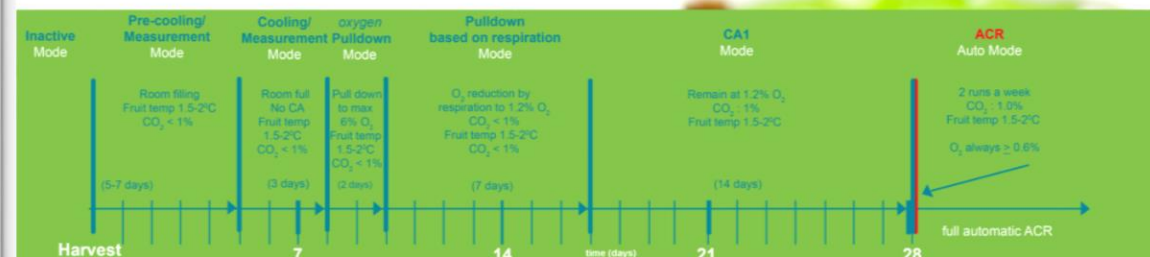
研究成果是最适合您产品的贮藏方案

系统自动执行贮藏方案



“我的水果”控制系统

Generic Protocol Fuji, Idared, Pink Lady, Cripps Pink Dynamic ACR



VAN CA technology
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www.van-amerongen.com

* Moisture loss 2.0 - 3.0 liters per ton / per month * At start pulldown, max T product = 2°C *
* Specific temperature sensitivity Cripps Pink: Temperature higher: 2.5-3°C *

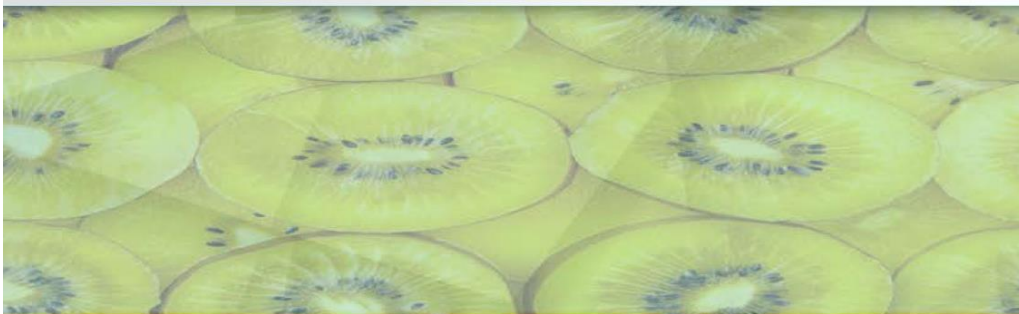
Please, note that this is a generic protocol. Conditioning can vary from region to region, and amongst others, will depend on the growing history in terms of weather conditions/climate and soil. Ask advice from a local university or research station. Van Amerongen is only the provider of CA technology. Local scientists however have in-depth knowledge on fruit physiology and storage experience.

FvdG/KJ-29.03.2017

This protocol is based upon years of experience & research and is assessed by Wageningen University - Food & Biobased Research

FOOD & BIOBASED RESEARCH
WAGeningen

贮藏方案



Golden kiwi storage information

The data mentioned below is only for reference. The optimal storage conditions depend on various factors, so there is no "one correct number" for everyone. Please feel free to post your questions below this message, so that other users, can share their experience and expertise.

Fruit information

Fruit type:	Kiwifruit (golden)
Binomial name:	Actinidia chinensis
Cultivar name:	'GA Gold'
Source fruit planting region:	New Zealand

Harvest maturity indicators

* Suitable for 'GA Gold' grown in New Zealand

Brix (sugar):	≥ 5.0 °
Dry material:	≥ 16.9%
Color:	≤ 112.9 °Hue

Recommended CA Storage Condition & Procedures

Temperature:	0.5°C
RH:	97-100%
Cooling	0.5°C, CO ₂ < 2%
O ₂ Pulldown (N ₂ injection):	To 5% O ₂ , CO ₂ < 2% (ASAP, up to 2 days)
O ₂ Pulldown (Respiration):	To 2 % O ₂ , CO ₂ < 2% (5 days)
CA condition:	2% O ₂ + 2% CO ₂ (7-12 day, or straight to ACR without CA)
ACR (Dynamic CA):	About 1.1% O ₂ according to the system, <2 % CO ₂ , target RQ = 1.6
Fully automatic ACR:	1 run per 3 days, 0 to 0.5°C. Target RQ = 1.6;
	O ₂ 1.6 to 1.1% CO ₂ 2%
Ethylene:	Non detectable (Ethylene decomposer active always)
Storage period:	Up to 1.5 months under CA condition

Physiological Information:

Respiration Rate at 0°C:	1.5-2 ml CO ₂ /kg/h
Ethylene production rate at 20 °C:	0.1 - 0.5 µl/kg/h
Ethylene production rate under CA:	< 0.1 µl/kg/h

Note:

1. Golden kiwis produce CO₂ faster than green kiwis, so CO₂ target level is lower.
2. Note that Golden kiwis do not require 'curing' to let the harvest wound heal.

Cannot find information in internet?

If your product is relatively new and no data is currently available, Fotein, a company under the CA technology Group, can provide a complete set of easy-to-use research facilities and guidance to help you conduct small field research yourself!

*If you want to know exactly what the best storage condition for your fruit is, please always get advice from an expert. Van Amerongen do not accept any liability for these recommendations.

Need advice or curious about which solutions are available for you?

Contact us now and we will be happy to help you! Info@van-amerongen.com or +31 344 670 570





Cherry storage information

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Fruit information

Fruit type:	Sweet Cherry
Binomial name:	Prunus avium L.
Cultivar name:	'Kordia', 'Regina'
Source fruit planting region:	The Netherlands (glasshouse and outdoors)

Quality parameters

'Kordia' (mean values)	
SSC (sugar):	20°Brix
TA (Titratable Acidity):	0.58%
SSC/TA:	34.5
'Regina' (mean values)	
SSC (sugar):	16°Brix
TA (Titratable Acidity):	0.65%
SSC/TA:	24.6

Precooling conditions

Condition:	Below 5°C by 4 hours after harvest.
Method:	Hydrocooling and forced-air cooling

Recommended CA Storage Condition

* Suitable for cultivars 'Kordia' & 'Regina' grown in the Netherlands

Temperature:	0°C
RH:	90-95%
O ₂ :	5-6%
CO ₂ :	12-14%
Ethylene:	No exogenous ethylene

Retail Outlet Display Considerations

Temperature:	Retail Outlet Display Considerations < 5°C (reduce stem browning, shrivel, develop of decay)
RH:	Not wetted (prevent splitting)

Physiological Information:

Respiration Rate at 0°C:	3-5mL CO ₂ /kg/h
Ethylene production rate:	Very low

Cherries can be stored for 2-3 weeks in conventional cold regular atmosphere (RA) storage, but for **up to 6 weeks under CA condition**.

Note:

Under regular low O₂ and/or high CO₂, many positive effects of CA storage of sweet cherries have been reported, including maintaining TA content, and retarding the decline in SSC, retention of firmness, stem color and brightness, and the reduction of surface pitting and microbial decay.

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Blueberry storage information

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Fruit information

Fruit type:	Blueberry
Binomial name:	Vaccinium sp.
Cultivar name:	'Bluecrop' 'Chandler' 'Aurora' 'Liberty' 'Duke' ...
Source fruit planting region:	The Netherlands, Argentina, Spain, Morocco, Chile, Poland (greenhouse and outdoors)

Harvest maturity indicators

Fully blue and firm

Recommended CA Storage Condition (Commercial)

* Suitable for cultivars grown in the Netherlands

Temperature:	0-1°C
RH:	90-95%
O ₂ :	3-4 %
CO ₂ :	9 %

Retail Outlet Display Considerations

Temperature:	< 5°C (reduce stem browning, shrivel, develop of decay)
RH:	Not wetted (prevent splitting)

Physiological Information:

Respiration Rate at 0°C:	3-5ml CO ₂ /kg/h
Ethylene production rate:	very low

Blueberry can be stored for 2-3 weeks in conventional cold regular atmosphere (RA) storage, but for up to 6 weeks under CA condition.

Note:

CA storage condition for other blueberry cultivars:

Imported blueberries	10% O ₂ + 10% CO ₂ (Frank, 2019-2020)
Centurion & Maru	2.5% O ₂ + 15% CO ₂ (Schotsmans et al., 2007)

Popular blueberry cultivars in NL (Commercial & Literature)

Chandler

Taste:	sweet aroma; one of the varieties with the best taste.
Cultivation:	outdoors
Availability:	June-September
CA condition:	3% O ₂ + 5-10% CO ₂ , 16 weeks (Ioana et. al., 2017)
Source of the fruits:	Arges, Romania

Aurora

Taste:	acidic
Cultivation:	outdoors
Availability:	June-September
Size:	medium to large,
CA condition:	13% O ₂ + 5-6% CO ₂ , >5 weeks (Jessica & Juan, 2016)

Liberty

Taste:	sweet, yet acidic
Cultivation:	outdoors
Availability:	June-September
Appearance:	Medium to large light blue fruit,
Size:	10-20mm
SSC (sugar):	7-16 °Brix
Storage period:	5-6 weeks
CA storage:	This variety can reach 95-96% of the export quality (other varieties are 70-75%)

Duke

Taste:	sweet, yet acidic
Cultivation:	greenhouse
Availability:	April-June
Size:	8-20mm (A AA AAA level)
SSC (sugar):	9-15°Brix
Storage period:	6 weeks

Duke is the standard product for long-distance transportation.

CA condition:	18 % O ₂ + 6-12 % CO ₂ (Harb & Jamil, 2004)
Respiration rate	(18% O ₂ +12% CO ₂): 12.1 ml CO ₂ /kg*h
Respiration rate (non-CA):	10.6 ml CO ₂ /kg*h

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Onion storage information

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Fruit information

Product type:	Onion
Binomial name:	<i>Allium cepa</i> L.
Cultivar name:	'Hyred' (red), 'Hercules' (yellow), 'Sierra Blanca' (white), 'Sherpa', 'Exhibition' (salad)
Source fruit planting region:	South-Estonia, Mexico, Germany

Quality parameters/maturity indices at commercial harvest

'Hercules' (yellow) in South-Estonia	
Dry matter:	10.93 % (Pöldma et. al., 2012)
SSC:	11.50 °Brix
Pungency:	7.13 µmol of pyruvic acid/g
Harvest standard:	70-80% of onions tops down
'Hyred' (red) in South-Estonia	
Dry matter:	11.40 %
SSC:	12.2 °Brix
Pungency:	7.83 µmol of pyruvic acid/g
Harvest standard:	70-80% of onions tops down
'Exhibition' (salad) in South-Estonia	
Dry matter:	5.45 %
SSC:	6.88 °Brix
Pungency:	3.46 µmol of pyruvic acid/g
'Sierra Blanca' (white) in Mexico	
Total carbohydrate content:	2.54 % (I.J. Rios-Gonzalez et. al., 2018)
Pungency:	1.27 µmol of pyruvic acid/g
'Sherpa' (yellow) in Germany	
Dry matter:	12 % (Praeger et. al., 2003)
SSC:	7.4 °Brix

Pretreatment

Pungent onion
Curing: field curing when temperatures are at least 24°C or forced air-curing by 12 hours exposure at 30 to 45°C.
Salad onion
Drying for 10 days at 25-30°C, then curing.

Recommended CA Storage Condition

* Suitable for cultivars 'Hercules' (yellow) & 'Hyred' (red) in South-Estonia	
Temperature:	2±1 °C
RH:	65-75 %
O2:	1-3 %
CO2:	5 %
Storage period:	5-6 months
* Suitable for cultivars 'Exhibition' (salad) in South-Estonia	
Temperature:	2±1 °C
RH:	65-75 %
O2:	1-3 %
CO2:	5 %
Storage period:	8 months
* Suitable for cultivars 'Sierra Blanca' white onion in Mexico	
Temperature:	2.5 °C
RH:	60-75 %
O2:	1 %
CO2:	1 %
Storage period:	7 months
* Suitable for cultivars 'Sherpa' (yellow) in Germany	
Temperature:	2 °C (Ernst et.al., 2003)
RH:	60-75 %
O2:	0.5-1 %
CO2:	N.A.
Storage period:	9 months + 3 weeks shelf-life Lower weight loss, much lower sprouting & rooting rate and higher firmness in CA than in RA (regular atmosphere)

Physiological Information:

Respiration Rate at 2°C:	Around 7 ml CO2/kg/h
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Note:

Longer storage periods lead to quality loss mainly because of rot and sprouting or rooting. Stored bulbs show increasing percentage of visible roots and rots with increasing air humidity:

*If you want to know exactly what the best storage condition for your fruit is, please always get advice from an expert. Van Amerongen does not accept any liability for these recommendations.

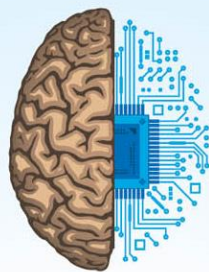
Need advice or curious about which solutions are available for you?

Contact us now and we will be happy to help you info@van-amerongen.com or +31 344 670 570



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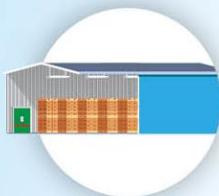
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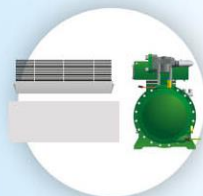


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