



Controlled Atmosphere storage systems for research capacity expansion

Elke Crouch & Gustav Lötze

Postharvest Lecturer and Researchers

Departement of Horticultural Sciences

in collaboration with
HORTGROscience / SAAPPA



Controlled atmosphere research need & CA facilities and equipment

Hortgro / SAAPPA feasibility study

Secured funding for following equipment / comparisons

“The plan is that this equipment will form part of the envisaged larger CA research facility to be established at the Department of Horticultural Science. The management systems will be capable of running a larger facility.”

Stellenbosch University strategic fund, funds PSA



CA equipment currently installed

CA systems of the following 3 suppliers:

Gas at Site (IsolCell)

Van Amerongen

Absoger



Treatments

1. **DCA-Chlorophyll Fluorescence (DCA-CF)**
+ Ethylene measurement, no scrubbing
one bin measuring respiration quotient (RQ)
(Gas at Site: HarvestWatch™ , Isolcell).
2. **DCA-CF + Ethylene measurement & scrubbing**
one bin measuring respiration quotient (RQ)
(Gas at Site: HarvestWatch™ , Isolcell).
3. **DCA-respiration quotient (DCA-RQ)**
+ Ethylene measurement, no scrubbing
(Van Amerongen, Advanced Controlled Respiration)
4. **XLO + Ethylene measurement & scrubbing (Absoger)**



Answered questions:

1. Compare DCA-CF, DCA-RQ and XLO
2. Does ethylene scrubbing improve long term storage (DCA-CF)?
3. All the other parameters of ease of the system control, support, communication etc. are evaluated.



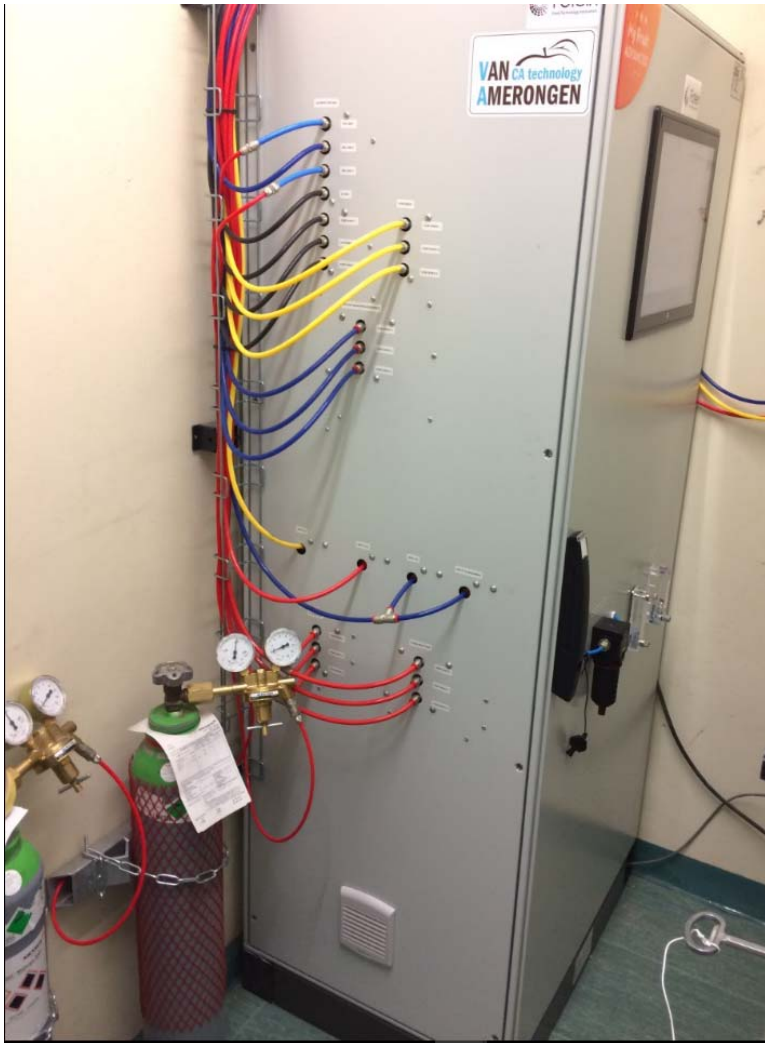
Gas at Site / Isolcell

DCA-CF

**+ / - Ethylene scrubbing
+ RQ measurement**



Van Amerongen system DCA-RQ



Absoger system XLO + Ethylene scrubbing



Fruit from Langkloof

- Fruit overmature due to last fruit in that season after installations were finished



	Firmness (kg)	Diameter (mm)	Mass (g)	Ground colour	Starch breakdown (%)	TSS (°Brix)	TA (%)
Before storage	8.11	69.22	137.9	4.1	67	12.0	0.52

Storage time

12 weeks CA at 0 °C

+

Regular atmosphere period -0,5 °C for 6 weeks

+

Shelf-life period at 20 °C



Maturity indices of Granny Smith fruit after 12 weeks of CA storage at 0 °C (14-08-2018).

	Firmness (kg)	Yellow Hue angle	Greenest Hue angle	Colour chart A38 Yellowest	Colour chart A38 Greenest	Colour chart A.38 Aver
DCA-CF + Ethylene scrubbing	8.2 a	112.9	114.6 a	5.9 ab	4.4 b	5.1 b
DCA-CF	8.2 ab	112.8	113.8 c	5.6 c	4.3 b	4.9 c
DCA-RQ	8.1 ab	112.6	114.3 ab	6.0 a	4.6 a	5.3 a
XLO + Ethylene scrubbing	8.1 b	112.8	114.0 bc	5.8 b	4.7 a	5.2 ab
Pr > F	< 0.0001	0.178	< 0.0001	0.0001	0.0001	0.0001
LSD	0.1	0.303	0.315	0.186	0.184	0.166

SVR
DFB

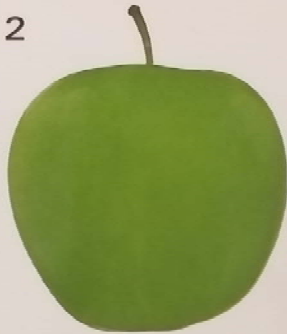
GRANNY SMITH-APPELS/APPLES
KLEUR COLOUR

STEL
SET A. 38

1



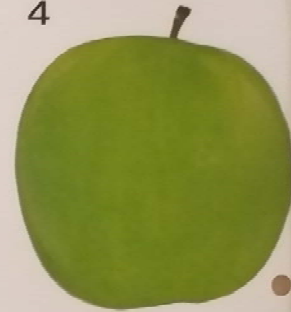
2



3



4



8



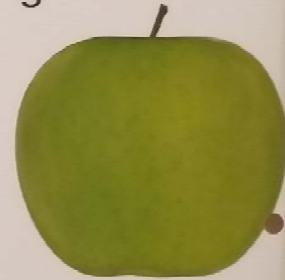
7



6



5



9



10



11



12



TSS ,TA and defects of Granny Smith fruit after 12 weeks of CA storage at 0 °C

	TSS (%)	TA (%)	Sun scald (%)	Greasiness (%)	Superficial Scald (%)
DCA-CF + Ethylene scrubbing	12.1 ab	1.36 b	6	3	0.6
DCA-CF	12.2 a	1.37 ab	6	3	0.0
DCA-RQ	11.9 b	1.43 a	7	0	0.0
XLO + Ethylene scrubbing	12.3 a	1.43 a	7	1	0.0
<i>Pr > F</i>	<i>0.032</i>	<i>0.046</i>	<i>0.993</i>	<i>0.272</i>	<i>0.405</i>
<i>LSD</i>	<i>0.236</i>	<i>0.063</i>	-	-	-

Maturity indices

After 12 weeks in CA at 0 °C

+

6 weeks RA -0,5 °C

	Firmness (kg)	Colour chart A38 Yellowest side	Colour chart A38 Greenest side	TSS (%)	TA (%)
DCA-CF + ethylene scrubbing	8.3 a	5.6	4.0	12,0	0.44
DCA-CF	8.2 a	5.7	4.0	11.8	0.46
DCA-RQ	8.0 b	5.6	4.0	11.7	0.43
XLO+ ethylene scrubbing	8.0 b	5.5	3.8	11.9	0.46
<i>Pr > F</i>	< 0.0001	0.361	0.089	0.391	0.075
LSD	0.102	-	-	-	-

Defects for Granny Smith Apples stored in Controlled Atmosphere for 12 weeks at 0 °C + 6 weeks RA at -0.5 °C

	Superficial Scald (%)	Internal Browning (%)	Light Core Flush (%)	Greasiness (%)	Sunscald (%)
DCA-CF + Ethylene scrubbing	0	4	2	12 ab	4
DCA-CF	0	3	3	17 a	2
DCA-RQ	0.6	0.6	7	0.6 b	3
XLO + Ethylene scrubbing	0	1	4	6 ab	5
<i>Pr > F</i>	0.521	0.176	0.896	0,015	0.416

Maturity indices for Granny Smith Apples stored in Controlled Atmosphere for 12 weeks at 0 °C + 6 weeks RA at -0.5 °C + 10 days shelf-life 20 °C

	Firmness (kg)	Yellowest (A38)	Greenest (A38)	TSS (%)	TA (%)
DCA-CF + ethylene Scrubbing	7.1 ab	9.4	7.2 a	11.6 a	0.37
DCA-CF	7.2 a	9.4	7.4 a	11.7 a	0.37
DCA-RQ	7.0 bc	9.4	6.8 b	11.3 b	0.38
XLO + ethylene scrubbing	6.9 c	9.2	6.8 b	11.6 ab	0,39
<i>Pr > F</i>	<i>< 0.0001</i>	<i>0.095</i>	<i>0.001</i>	<i>0.039</i>	<i>0.075</i>
<i>LSD</i>	<i>0.119</i>	<i>0.207</i>	<i>0.305</i>	<i>0.255</i>	-

Defects for Granny Smith Apples stored in Controlled Atmosphere for 12 weeks at 0 °C + 6 weeks RA at -0.5 °C + 10 days shelf-life 20 °C

	Superf. Scald (%)	Internal Browning (%)	Light Core Flush (%)	Greasiness (%)	Watercore (%)
DCA-CF + Ethylene scrubbing	1.7	1.9	45	100	19 ab
DCA-CF	0.6	2.5	41	100	33 a
DCA-RQ	1.1	1.4	48	100	12 b
XLO + Ethylene scrubbing	3.3	1.9	41	100	4 c
<i>Pr > F</i>	0.521	0.994	0.896	1	<0.0001



In conclusion



- **This is Year 1 of the project**
- **Thank you to everyone that made this project possible in this season**
- **We look forward to longer term storage trials with fruit from the beginning of the optimum harvesting window in the next season.**

