Postharvest Handling of Ornamentals Part 2

Typical Ethylene Concentrations

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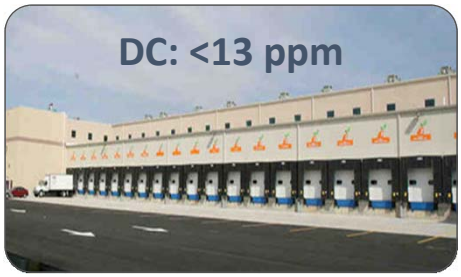


Ethylene in the handling chain

Type of participant	Number of samples	% Samples with ethylene (>10 ppb)	Range (ppm)
Grower #1	35	40	0.08-1.19
Grower #2	64	9	0.08-0.22
Grower #3	65	97	0.71-7.62
Grower #4	14	0	
Wholesaler #1	109	22	0.02-0.64
Wholesaler #2	90	90	0.06-1.44
Wholesaler #3	74	70	0.01-0.39
Wholesaler #4	82	11	0.07-0.23
Wholesaler #5	169	98	0.14-12.99
Wholesaler #6	193	99	0.05-9.70
Wholesaler #7	36	92	0.22-1.06
Wholesaler #8	107	100	0.14-45.0
Retailer #1	98	6	0.13-0.24
Retailer #2	6	0	
Retailer #3	115	56	0.08-2.25
Retailer #4	52	12	0.06-0.28
Retailer #5	49	24	0.04-0.42
Processor #1	133	95	0.17-133.3
Processor #2	157	35	0.05-1.07
Processor #3	84	96	0.23-1.00
Total	**1732**	**63%**	

Ethylene ranged from 10 ppb to 133 ppm

63% of 1732 samples were >10 ppb

Source: Skog et al., 2001

Control of Ethylene

Good Management

- Good temperature management
- Adequate ventilation
- Avoid combustion engines – use battery operated forklifts
- Sanitation – removing rotting plant material

Chemical Solutions

- Ethylene absorbers e.g.
  - Potassium permanganate ($KMnO_4$)
  - It'sFresh
- Ethylene binding site inhibitors

Ethylene action inhibitors: Silver compounds

- Silver based solutions e.g.
  - Silver nitrate ($AgNO_3$)
  - Silver thiosulfate (STS)
- Taken up by the stem - systemic

SOURCES:

- Recipe http://www.phytotechlab.com/pdf/stssolution.pdf
- Buy it on Amazon (other interesting uses!)
- Chrysal AVB http://www.chrysal.com/int/Home/Products/Post-harvest-Treatments/Chrysal-AVB-Concentrate.html
- Rogard and Silgard

Ethylene action inhibitors : 1-MCP

Gas – generated in situ; available as a powder or tablets

EthylBloc (Floralife/Smithers Oasis)

Ethylene Buster (Chrysal)

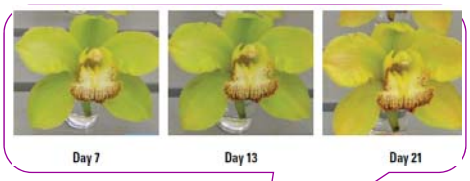
Ethylene Buster as tablets with an activator kit or sachets

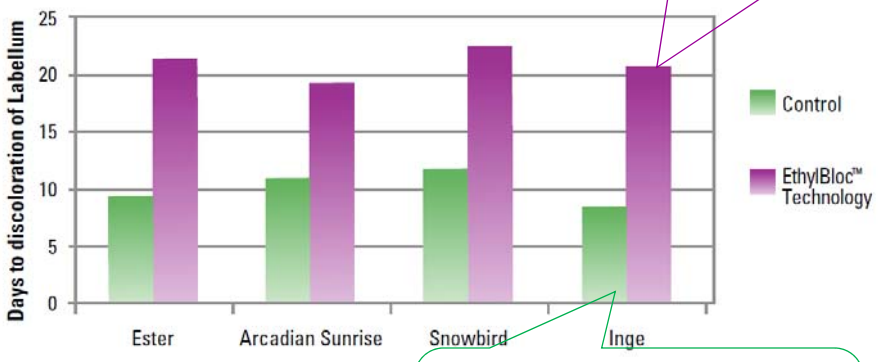
http://www.chrysal.com/int/Home/Products/Plant-Care/Chrysal-Ethylene-Buster.html

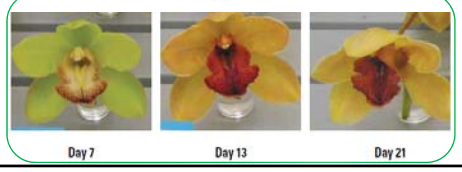
EthylBloc Sachets
http://www.floralife.com/en/products/grower/ethylbloc-sachet

Ethyl Bloc Truck kits
http://www.floralife.com/cms_assets/File%20Library/FloralIfe/Product_Pages/Stage2/EthylBloc_TruckKits_ProductSheet.pdf

Cymbidium







Water Quality and Sanitation

Vase life (days) of flowers held in clean or dirty water (100 million cfu/ml)

Species	Clean	Dirty
Chrysanth	15	10
Rose	10	4
Snapdragon	11	7
Stock	9	6

- Keep water clean
- Use sanitizers
- Keep buckets clean
- Biofilms (slime) can form – wash carefully

Apply same techniques used in fresh-cut processing for fresh-cut cut flowers

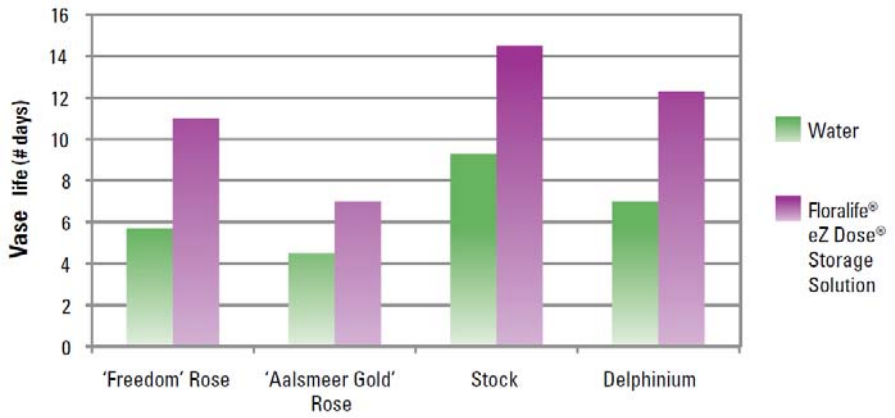
Flower Food

- Pulsing solutions - "carbo loading"
- Vase life or holding solution – "maintenance diet"

- Flower food can contain:
  - Sugar (2-20% sucrose)
  - Antimicrobial
  - Acid
  - Wetting agents
  - Silver compounds
  - Dyes to tint flowers (not to prolong life)

Food supply has become very specialized and flower food is formulated for specific flower species

Flower food - Pulsing



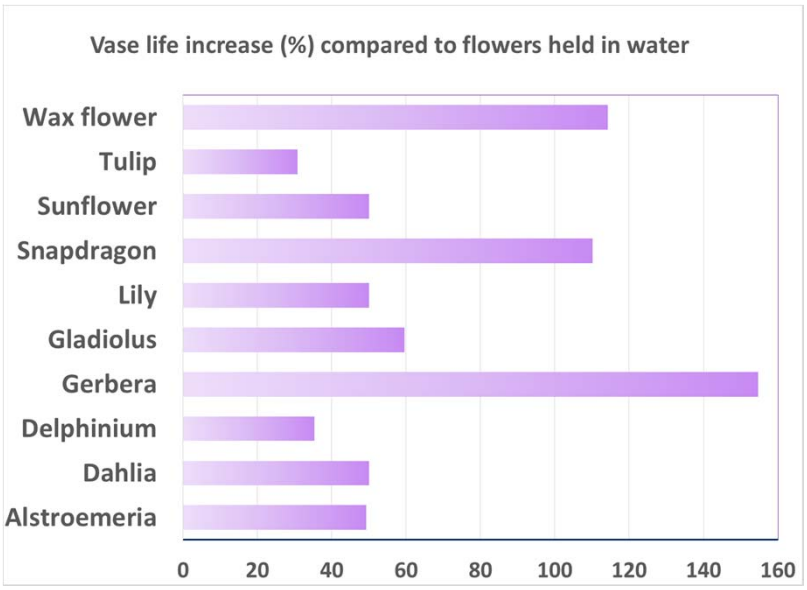
Floralife® eZ Dose® Storage Solution vs. water

- Flowers in buckets for 2 days at 2-3C / 36-38F (shipping)
- Then 20-21/ 68-70F C for 3 days (retail)
- Vase life in Floralife Crystal Clear® Flower Food

Roses

Rose Cultivar	Water	Crystal Clear	Premium Rose Flower Food
Akito	4	9	18
Lindsey	7	7	9
Orlando	7	11	14
Average (12 varieties)	**6.5**	**10.4**	**14.2**

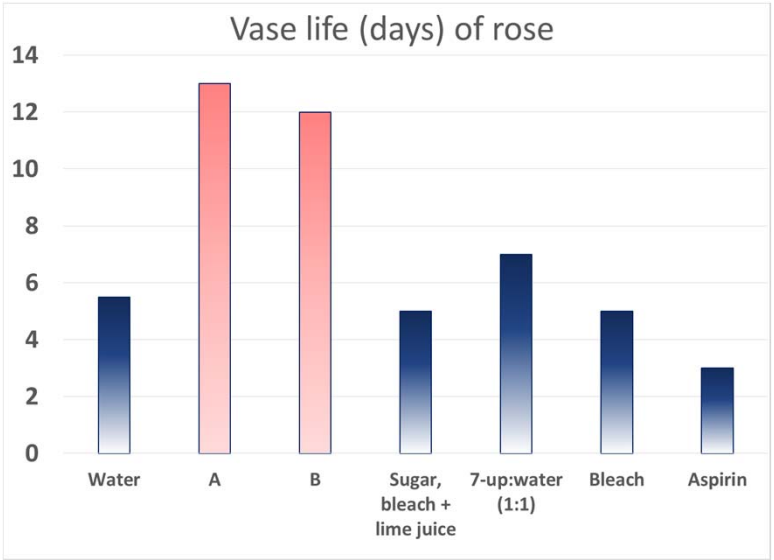
Photos and data courtesy Floralife



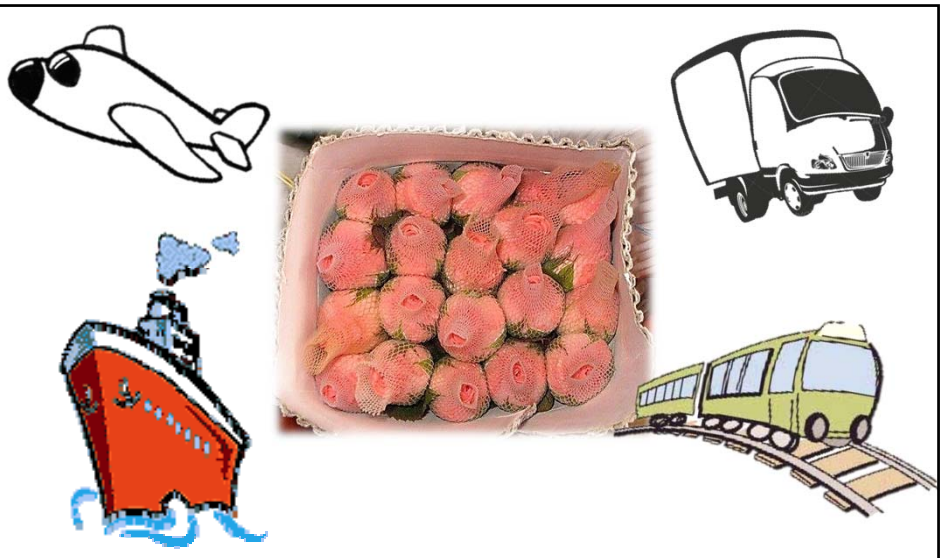
Commercial products available from

www.floralife.com www.chrysal.com

Commercial Flower Food versus Home Remedies



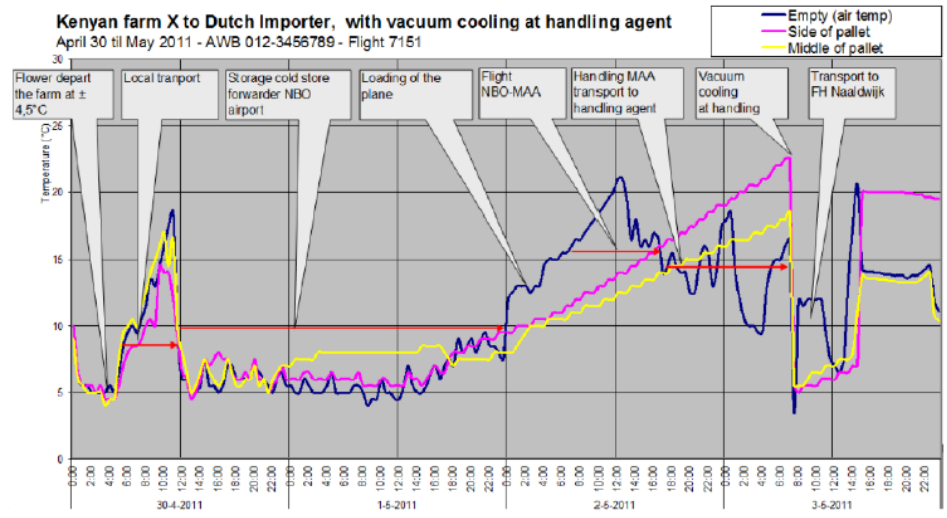
http://www.floralife.com/cms_assets/File%20Library/Floralife/Research_Updates/Flower%20Vase%20Solutions%20Research%20Updates/Floralife_Research_12-07_vs-Homemade.pdf



Cut Flower Logistics
Time versus **Temperature**

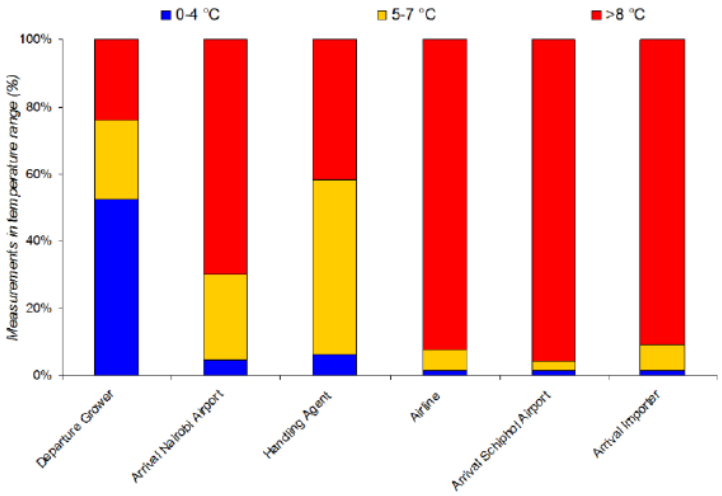
Air freight from Kenya

Figure 12 Example graph; one of the measurements with the warmest supply chain.



Source: A study of the Kenyan-Dutch horticultural supply chain. Dutch Ministry of Economic Affairs, Agriculture & Innovation; Hortiwise; FlowerWatch B.V. http://www.hortiwise.com/projects.htm

Product Temperatures at Different Stages of the Kenyan-Dutch Flower Supply Chain (70 shipments)



Source: A study of the Kenyan-Dutch horticultural supply chain. Dutch Ministry of Economic Affairs, Agriculture & Innovation; Hortiwise; FlowerWatch B.V. http://www.hortiwise.com/projects.htm

Sea Freight Requirements
1. Plant selection

Plant selection is essential - Not all plant plant species and not all varieties can have good vase life after long shipping times

Freesia cultivars 'Ambassador', 'Blue Moon' and 'Yvonne' can endure 14 days container transport, on condition that the flowers are harvested very green and are pretreated in an AVB solution. The flowers should be transported in water at a temperature of 0.5°C.

Reference: Harkema & Mensink, 2009. FlowerTECH vol. 12 (no. 4), 10-12

Sea Freight Requirements
2. Cold Chain

Temperature accounts for **70%** of the success of sea shipments

Degree days = product temperature (°C) x transport time

e.g. 20 degree-days =

- 20 days at 1°C (34F)
- 5 days at 4°C (39F)
- 1 day at 20°C (68F)

Cool at grower

Transport cold

Recool prior to 'stuffing' container

Monitor container temperature during shipment

Keep cold on arrival

Keep cold during customs checks

Sea Freight Requirements
3. Packaging

Packaging requirements differ between air and sea freight

Bottom air delivery of most containers – vents change

Better ventilation reduces ethylene problems (Bril, 2014)

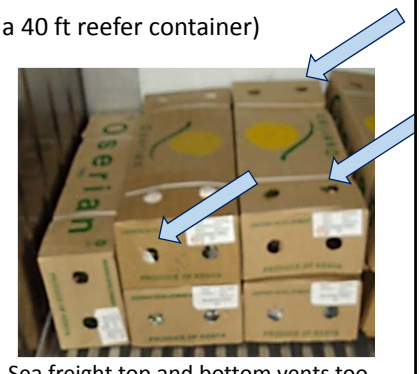
Boxes must be stronger:

- heavier loads

(955 airfreight boxes in a 40 ft reefer container)

- high RH

Air freight - End vents only



Sea freight top and bottom vents too

Cost (from Kenya to Europe)

- 11 tonnes flowers by air $20,000-25,000
- 1 container (11 tonnes) $10,000-$15,000 (Colombia to Europe has better sea freight charges)

Carbon emissions
(from Kenya to Europe)
By air = 43,498 kg
By sea = 5,653 kg
87% savings!

Source: van Willegen & Bril, 2013. A study on the Kenyan-Dutch Sea Freight Supply chain for roses. VGB publication. Prepared by Hortiwise http://www.hortiwise.com/projects.htm

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