Climate Change in the Ornamental Sector – A Breeder's Perspective

Dr. Robert Boehm

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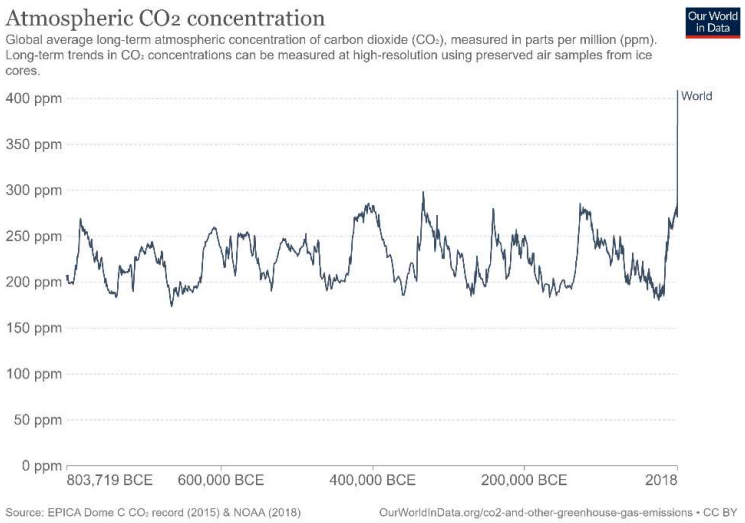
The Selecta Group

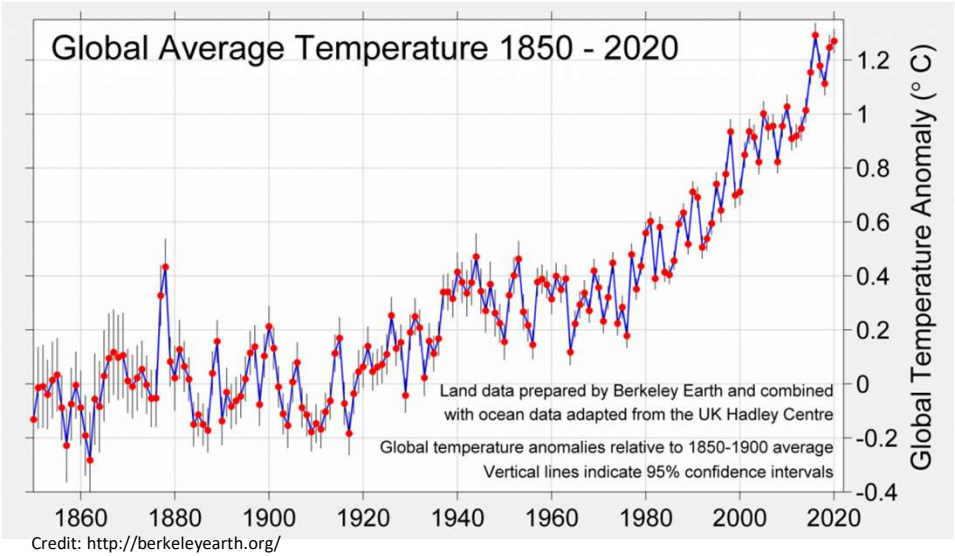
We are selecta one, a company globally leading in breeding, growing and marketing of vegetatively propagated ornamental plants.

With 11 own production sites and sales offices in Europe, Africa, Asia and America, we serve all relevant markets worldwide.

Climate change is a reality



Credit: https://ourworldindata.org



Credit: http://berkeleyearth.org/

Credit: https://climate.nasa.gov/effects/

Impact for ornamental culture

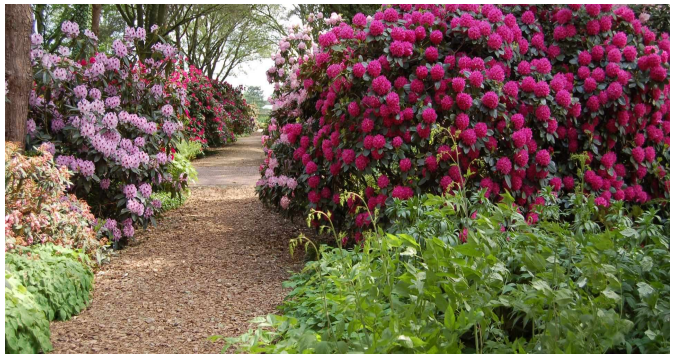
- Extended care and water supply
- Heat stress damages
- Reduced ornamental value
- Increased Susceptability for pests & diseases
- Dissapointed consumer

Credit: https://www.nature-and-garden.com/gardening/

Urban gardening

Credit: https://arborhilllandscaping.com/

Landscaping



Credit: https://www.park-der-gaerten.de/

Woody plant Arrangements

Impact for ornamental culture

- Extended care and water supply
- Heat stress damages
- mental value
- for pests & diseases

High demand for drought and heat stress tolerant plants

Credit: https://www.nature-and-garden.com/gardening/

Urban gardening

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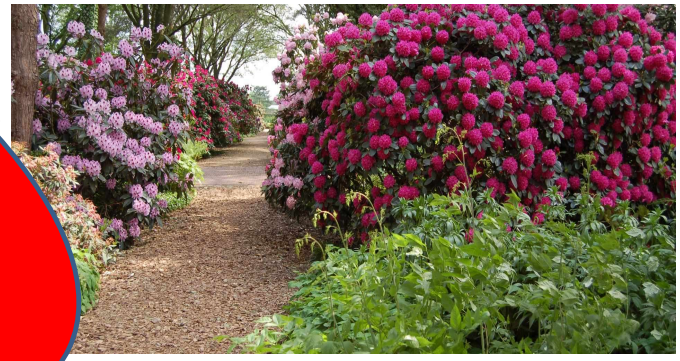
Landscaping



gaerten.de/

Woody plant Arrangements

Natural drought stress adaptations

Morphological :

- Compact, delayed growth
- Elongated root system
- Stoma density and distribution
- Hairy or waxy leaf surfaces

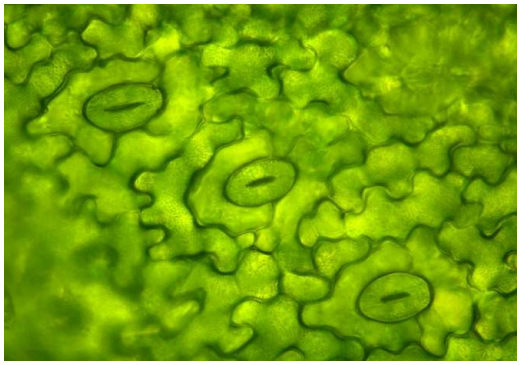
Physiological :

- Altered stoma management (ABA metabolism)
- Osmoregulation capacity

Complex :

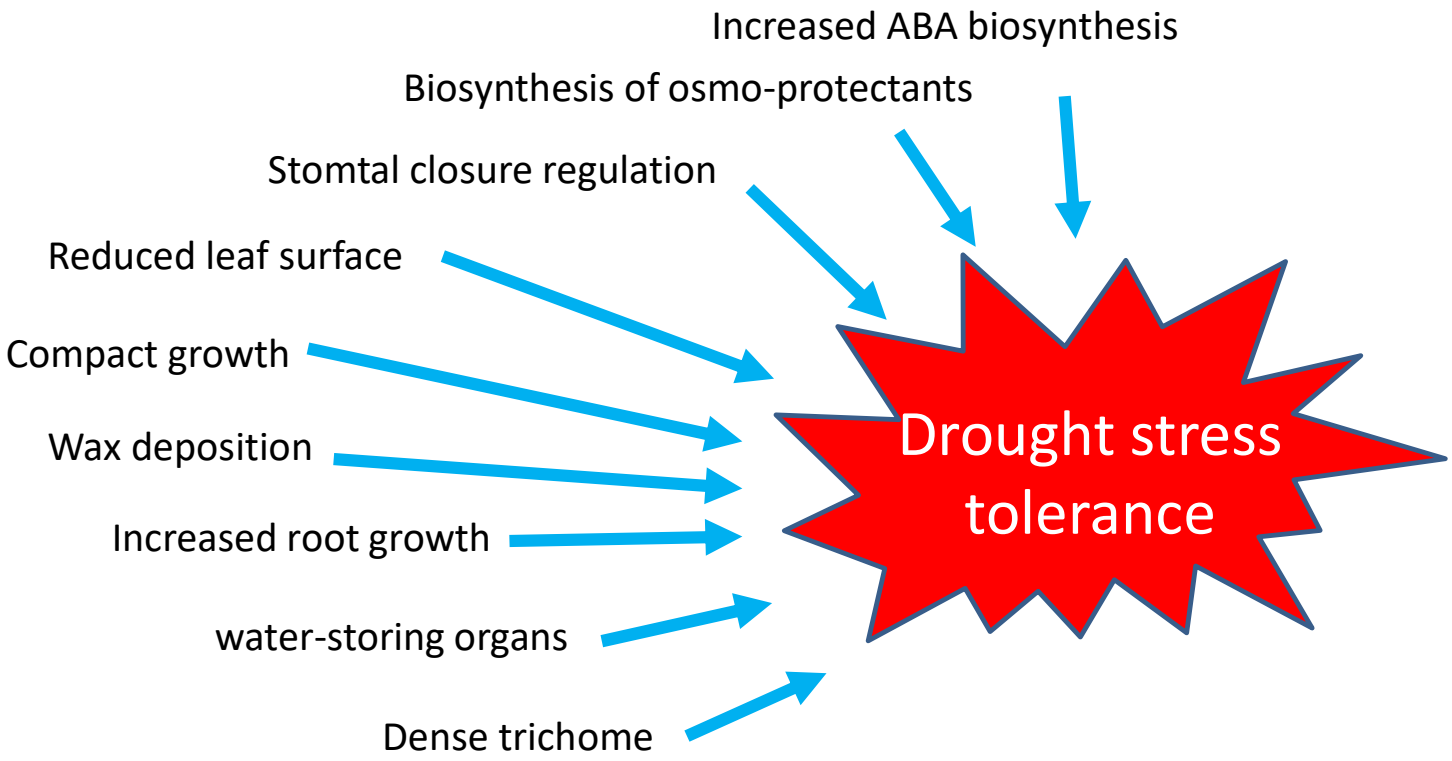
- Tolerance to high leaf temperatures
- High recovery rate after wilt
- High water use efficiency

Credit : https://pflanzen-fuer-dich.de/



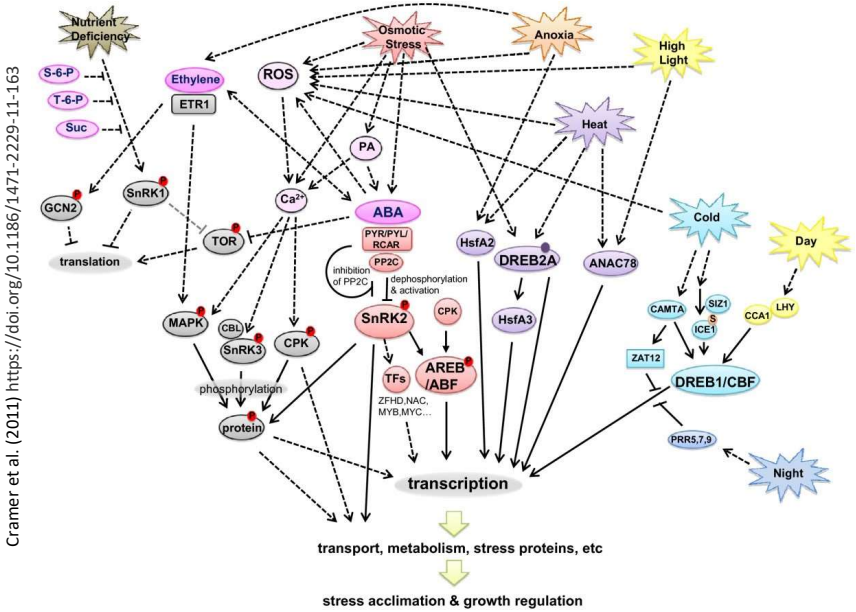
Credit: iStock.com/barbol88

Breeding strategies for drought stress tolerance

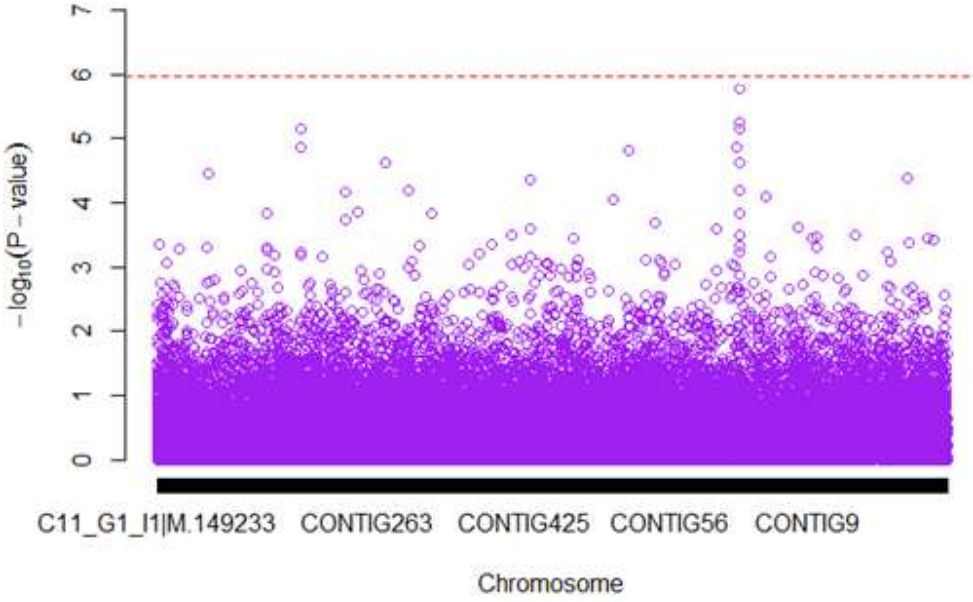


Genetic background of abiotic stress tolerances

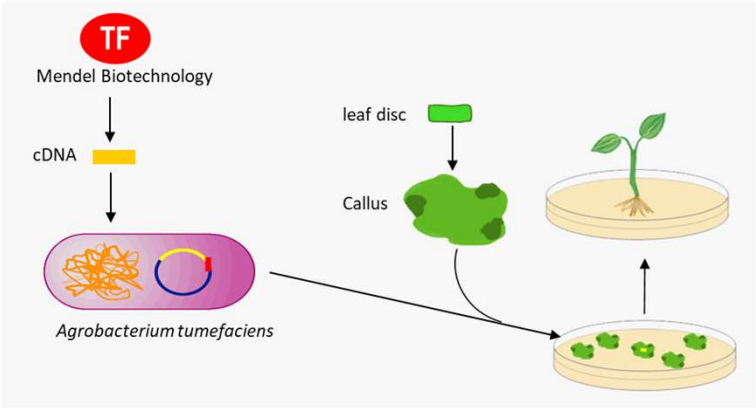
- Highly quanitative traits
- Many mechanisms involved
- Polygenic, multilocus molecular base
- Complex inheritance
- Hard to deliberately pyramidize by crossing



Cramer et al. (2011) https://doi.org/10.1186/1471-2229-11-163

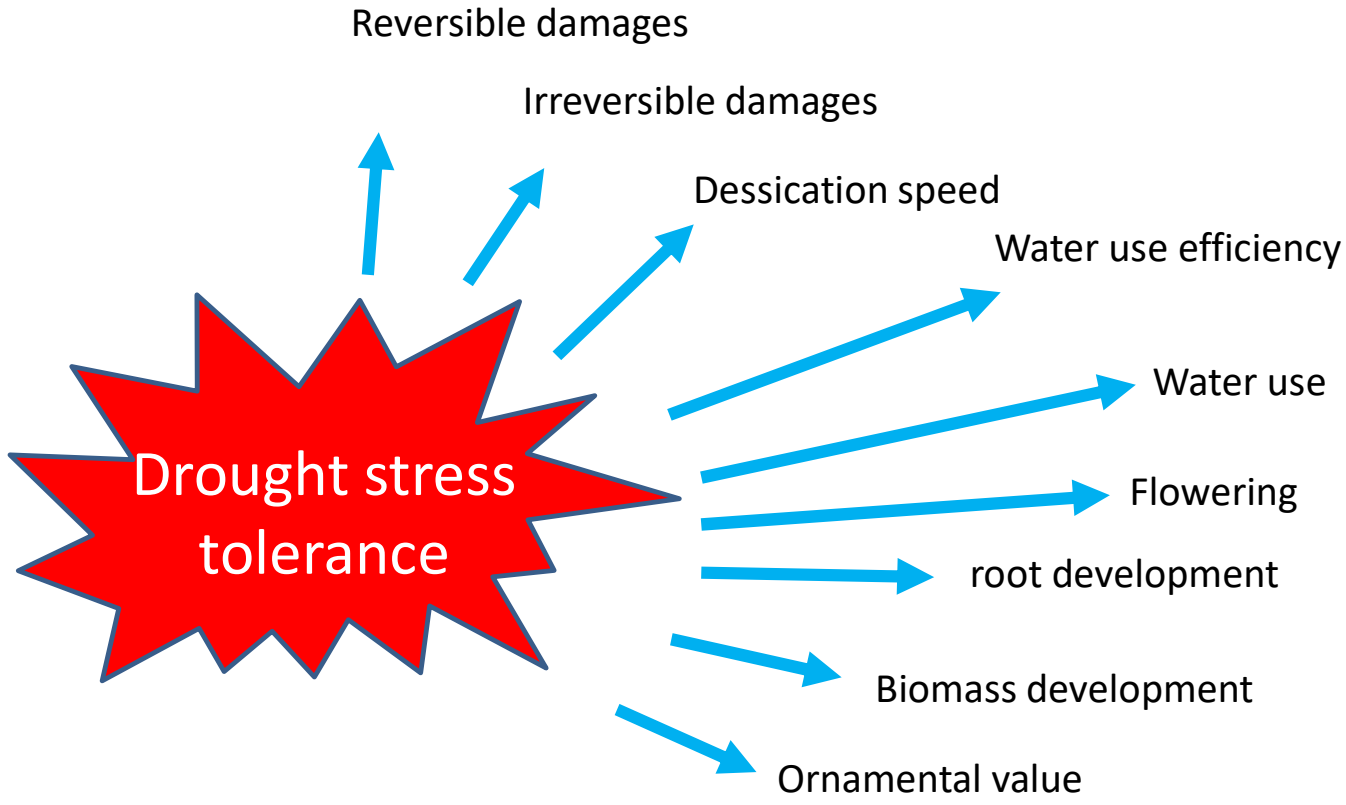


Biotechnological approach at Selecta



Transcription-factor	Protein familiy	trait
CBF1	AP2 TF	Frost
CBF2	AP2 TF	Frost
CBF3	AP2 TF	Frost
CBF4	AP2 TF	Frost, Drought
G1073	AT-hook TF	Drought
G481	NF-YB	Cold, Drought
G1274	WRKY TF	Cold, Drought
G47	AP2/ERF	Drought
G682	MYB TF	Cold, Drought, Heat
G1792	ERF TF	Pathogene, Drought. Cold
G28	ERF TF	Pathogene
G913	AP2 TF	Cold, Drought
G2133	AP2/ERF	Drought
G664	R2R3 MYB TF	Cold
G634		Drought
G1795	ERF TF	Pathogene, Drought

Breeding strategies for drought stress tolerance



Phenotyping Drought Stress in Baskets

- Variants: well-watered, watering weekly and 2-weekly
- Repeated visual evaluation over 4 weeks

- Water use (WU) : ml/d
- Water use efficiency (WUE) : g fg/g water
- Reversible threshold water content (TWC_{rev}) : mbar
- Irreversible threshold water content (TWC_{irr}) : mbar
- Desiccation speed (DS) : dOV/dt
- Biomass 10 weeks after cutting
- Biomass ratio fw/dw
- Flower canopy (FCC)
- overall ornamental value (OV

Selection for tolerant genotypes/varieties


PH 2011 2954

PH 2011 2977


PH 2011 2860

PH 2011 2929

PH 2011 2961


PH 2011 2918


PH 2011 2840


Lilac Dark Vein
(Reference line)

Pictures taken after 14 days water withdraw, before watering

Substitution by new cultures

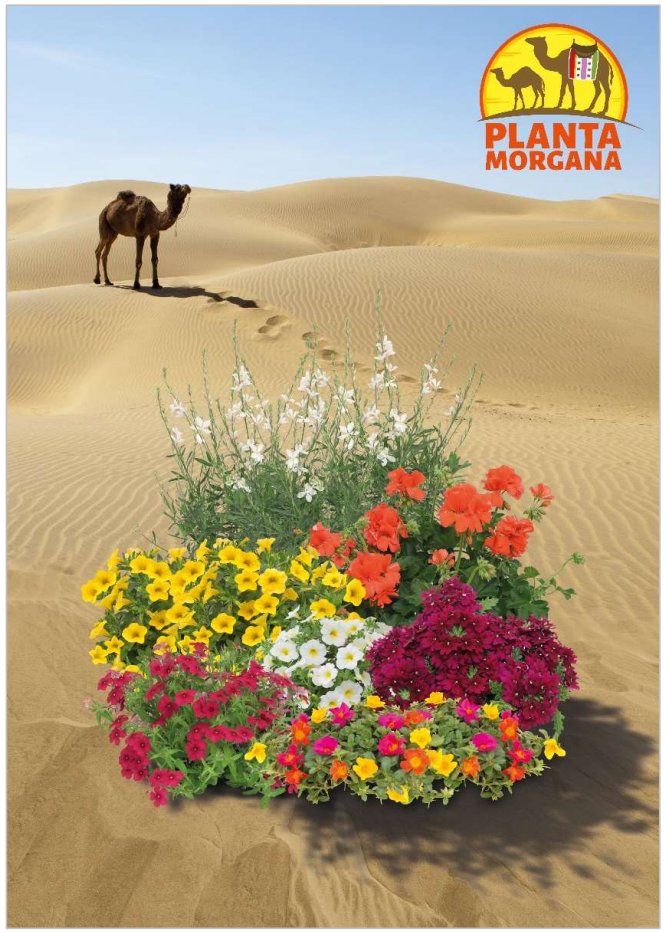
- Species with naturally evolved plant stress tolance mechanisms
- C4/CAM-metabolism, drought-adapted morphology
  - Grasses
  - Crassulaceae (Sedum, Echeveria)
  - Xerophytes (Helichrysum, Calocephalus)
  - Others (Portulak, Brachyscome, Felicia)






Marketing tolerant Varieties/Cultures

- Recommendation of more drought stress tolerant plant series
- Marketing with POS-material (pots, banner, label)



Take-home message

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Strategy	Prerequisite	
Biotechnological strategy	Detailed molecular knowledge of pathways, genes and regulation network	
Breeding strategy	Successful pyramidization of different pathways. Acceptance of compact plants	
Selection strategy	Characterization tools for drought stress tolerance	

The Future ?

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