Climate Change in the Ornamental Sector – A Breeder’s Perspective
Dr. Robert Boehm
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://climate.nasa.gov/effects/
Credit: http://berkeleyearth.org/
Credit: https://ourworldindata.org
Impact for ornamental culture

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

Urban gardening

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

Landscaping

Credit: https://arborhilllandscaping.com/

Woody plant Arrangements

Credit: https://www.park-der-gaerten.de/
Impact for ornamental culture

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

High demand for drought and heat stress tolerant plants

Urban gardening
Landscaping
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

- Increased ABA biosynthesis
- Biosynthesis of osmo-protectants
- Stomatal closure regulation
- Reduced leaf surface
- Compact growth
- Wax deposition
- Increased root growth
- Water-storing organs
- Dense trichome

Drought stress tolerance
Genetic background of abiotic stress tolerances

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

Biotechnological approach at Selecta

<table>
<thead>
<tr>
<th>Transcription-factor</th>
<th>Protein family</th>
<th>Trait</th>
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<td>G1795</td>
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<td>Pathogenesis, Drought</td>
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</table>
Breeding strategies for drought stress tolerance

- Reversible damages
- Irreversible damages
- Dessication speed
- Water use efficiency
- Water use
- Flowering
- Root development
- Biomass development
- Ornamental value

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

Pictures taken after 14 days water withdraw, before watering
Substitution by new cultures

- Species with naturally evolved plant stress tolerance 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

<table>
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<th>Strategy</th>
<th>Prerequisite</th>
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<tr>
<td>Biotechnological strategy</td>
<td>Detailed molecular knowledge of pathways, genes and regulation network</td>
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<tr>
<td>Breeding strategy</td>
<td>Successful pyramidization of different pathways. Acceptance of compact plants</td>
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<tr>
<td>Selection strategy</td>
<td>Characterization tools for drought stress tolerance</td>
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The Future?
Thank You!