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Deep roots, better crops? Investigating root and shoot traits in historical and modern pea genotypes

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INTRODUCTION

The increased interest in using mature peas for human consumption requires the development of new pea cultivars with focus on taste and appearance as well as resilience. In the research project PEAS & LOVE we have examined 300+ pea accessions for suitability as mature peas for food by investigating different aspects such as protein content, taste and agronomic relevance. With focus on both above- and belowground traits we are investigating whether breeding for increased yield and harvestability has affected pea drought tolerance.

EXPERIMENTS

Six genotypes spanning 100 years of breeding history was grown in 1.5 m tall rhizotubes. Leaf morphology varied from leafed wildtype to the *afila* type. At anthesis two treatments were imposed; well-watered and drought with four replicates of each. The experiment was terminated after 35 days of treatment.

CULTIVARS

- Brunært fra Nakskov
- Snedinge
- Unica
- Sirius
- Ingrid (*afila* leaf type)
- Orchestra (*afila* leaf type)

MEASUREMENTS

Height and BBCH was determined continuously during the experiment and soil water content determined by TDR sensors. Root development was determined by imaging followed by analysis using the RootPainter software. From initiation of the drought treatment stomatal conductance was measured four times by a Li-cor600 on the newest fully developed leaf.

Leaf area and biomass was determined at harvest. Tubes were cut in sections and root biomass, root anatomy, $\delta^{13}C$ and $\delta^{15}N$ in aboveground biomass will be determined.

RESULTS

- Significant effect of drought treatment on all parameters
- Significantly larger growth penalty in Brunært subjected to drought
- No clear development in drought tolerance over time
- Awaiting root data

SOIL WATER CONTENT

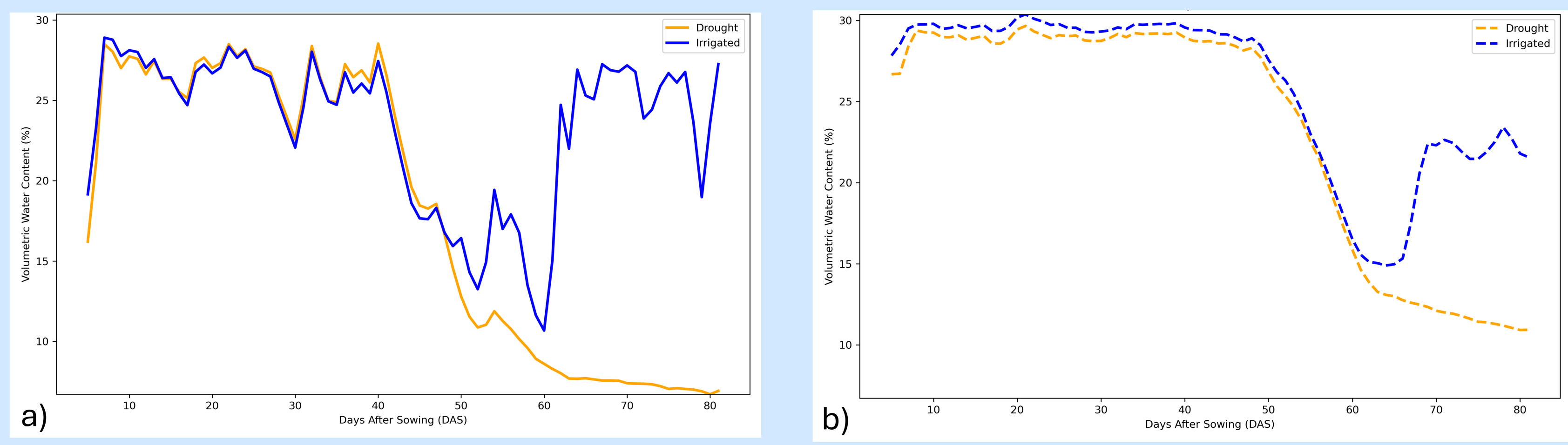

Figure 1. Soil water content at a) 20 and b) 90 cm depth under drought and well-watered conditions respectively

BIOMASS

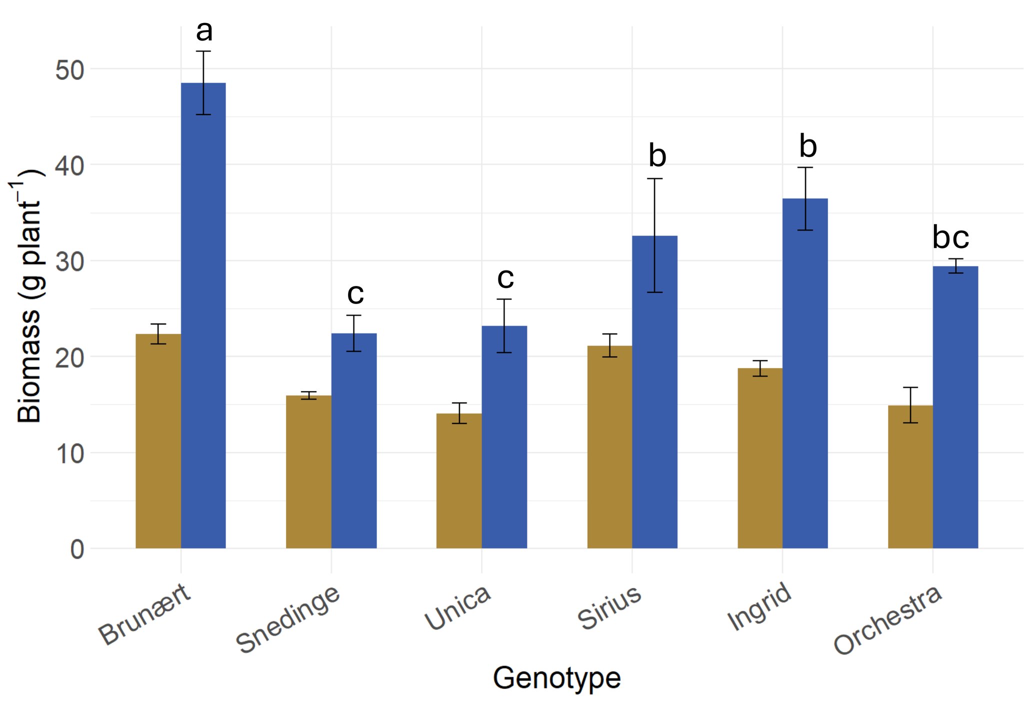

Figure 2. Plant biomass at harvest. Bars show means (n=4) and SE.

LEAF AREA

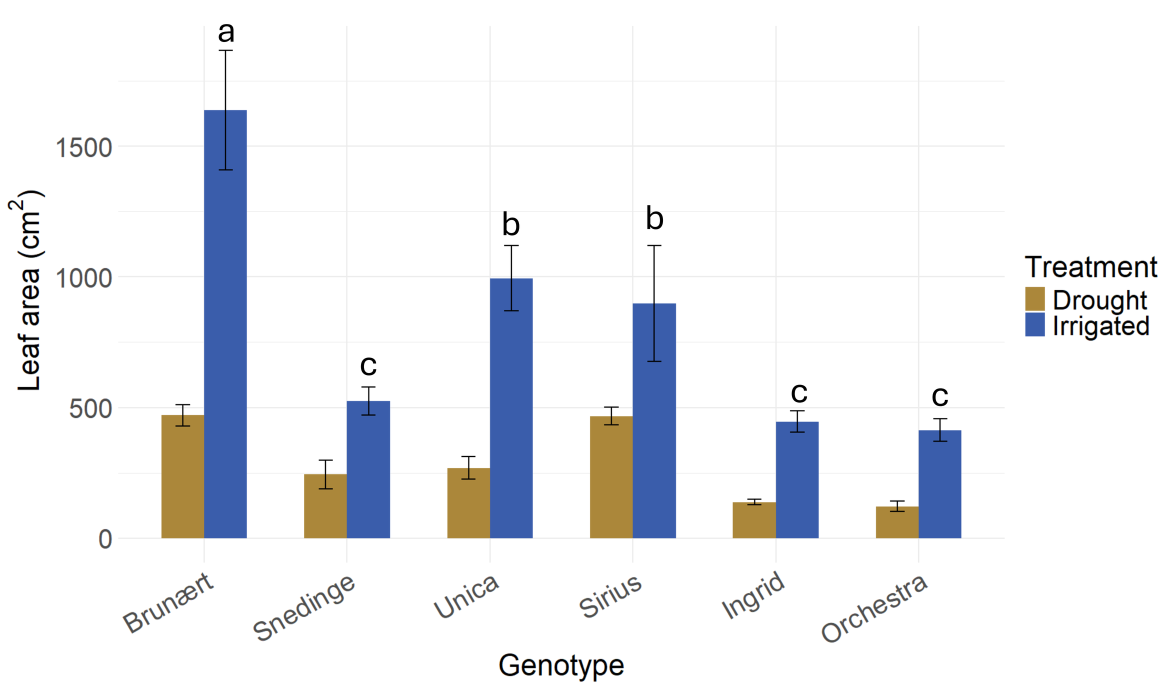

Figure 3. Leaf area at harvest. Bars show means (n=4) and SE.

STOMATAL CONDUCTANCE

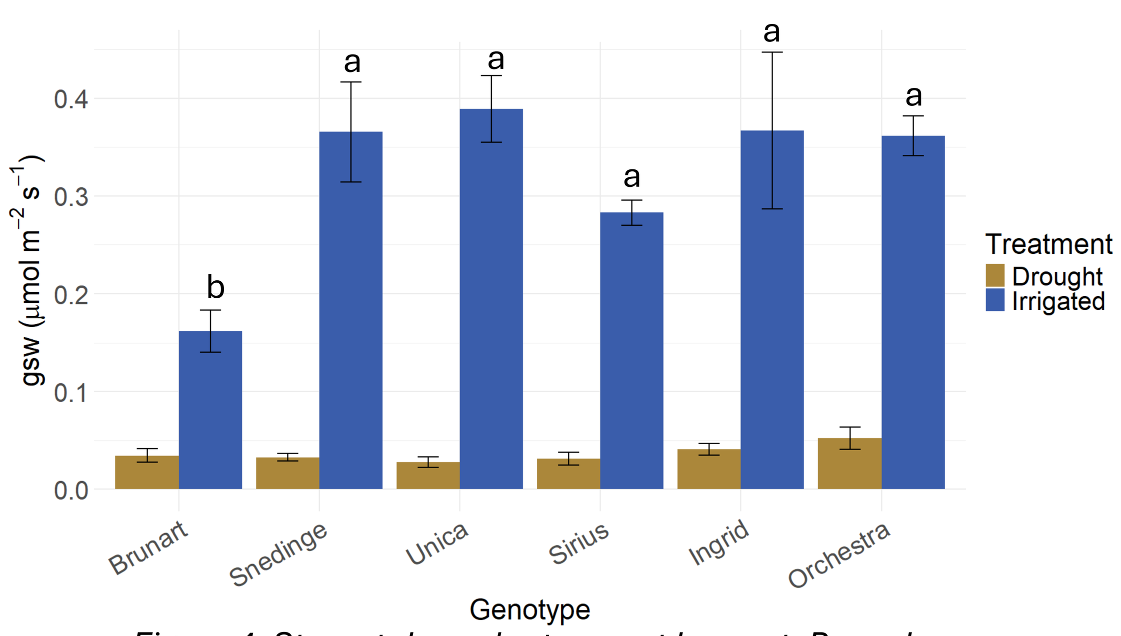

Figure 4. Stomatal conductance at harvest. Bars show means (n=4) and SE.

CONCLUSION

Drought stress significantly reduced biomass, leaf area and stomatal conductance of all cultivars. However, no clear trend was observed in effect of breeding age of the cultivar except for the oldest cultivar *Brunært fra Nakskov*, which had the largest growth reductions. No pre-treatment differences in rooting depth was found between cultivars. Further studies on ^{13}C, root biomass and root anatomy will reveal the potential belowground contribution to drought tolerance.

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gudp
ICROFS Organic RDD
BELOWGROUND CROP ECOLOGY Groundbreaking