UNIVERSITÄT HOHENHEIM
Institute for Plant Production and Agroecology in the Tropics and Subtropics
Crop Water Management in the Tropics and Subtropics (380c)

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Potential Yield of Venezuelan Maize Varieties Under Variable Water Supply

Introduction

Erratic rainfall patterns have caused severe drought conditions in Venezuela directly affecting white maize (*Zea mays* L.) production, increasing the economic risk for smallholders and compromising food security. Maize varieties resistant to drought are among the few options smallholders can employ to increase yield stability in their production system.

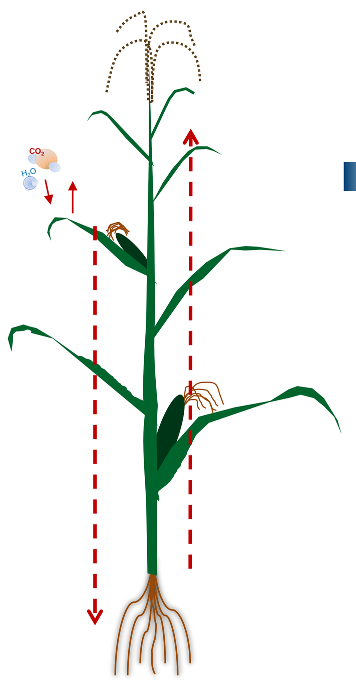
Stagnation of production level

current production is 49% lower than the yield for the same hybrids obtained in experimental optimal conditions.

Climate change vulnerability

the future pressure on environmental services in rural areas will increase in order to meet food security and economic development

This negative current situation can increase the food insecurity not only for rural people but also for poor people in urban areas where over 93 percent of Venezuela's population live



Research Questions

- Under drought, the formation of grain-yield on each hybrid is related to the expression of plant growth, root-shoot relations, or/and gas exchange?
- Secondary traits might be considered as selection criteria for drought tolerance in white maize?

Conclusion

- Leaf water potential (Ψ_w), root hydraulic conductivity (**Lp**), stomatal conductance (**g_s**), and water use efficiency (**WUE**) are effective indicators to drought tolerance in white maize
- **Danac-223** is recommended for use in developing drought tolerance in white maize breeding programmes in Venezuela

Results

Trait	Treatment	Variety: D-3273	D-842	D-223	D1B-718	D1B-273
Grain Yield (g plant^{-1})	WW	9.9	0.2	10.0	7.2	2.8
	WD	0	0	7.4	2.2	0.4
WUE (P_N/g_s) Water Use Efficiency	WW	0.08	0.11	0.06	0.09	0.07
	WD	0.03	0.03	0.10	0.04	0.09
P_N & g_s Photosynthesis & stomatal conductivity		82%↓	95%↓	96%↓	88%↓	88%↓
Ψ_w Leaf water potential	WW	-0.14	-0.19	-0.14	-0.17	-0.16
	WD	-0.76	-0.35	-0.62	-0.51	-0.51
R/S Root-Shoot radio	WW	0.7	0.3	0.4	0.3	0.9
	WD	0.8	0.1	0.5	1.2	0.6
Lp Hydraulic conductivity	WW	1.1	0.6	1.1	1.6	0.8
	WD	0.5	0.5	0.9	0.9	0.5

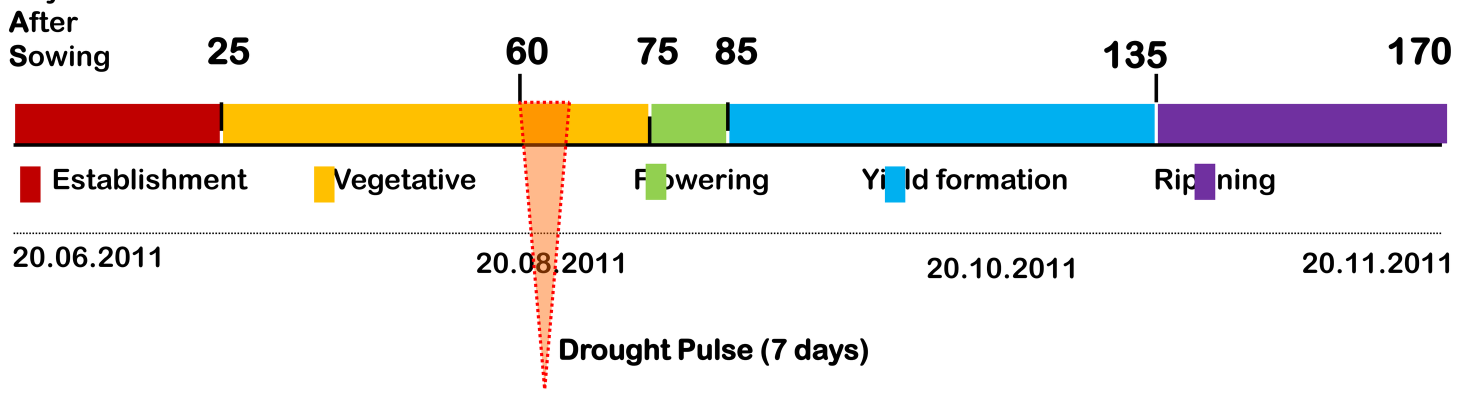
The higher sterility rate was observed in D-3273 and D-842, where no kernels per cob, thus no grain yield was achieved in WD plants

Under variable water supply a variation in SWC might induce a tight stomatal closure, therefore plant status can be maintained within a range of 20 to 4% of SWC

Changes in Lp could optimize soil water use and together with the stomatal regulation may be the driving forces of the gradient among the observed soil-root-plant-atmosphere continuum in tropical maize.

Methodology

Time Line:



- 3 Commercial hybrids: D-3273, D-842, D-223 and 2 experimental: D1B-718 (C4) and D1B-273 (C6) were used.
- At greenhouse conditions: 11km SW of Caracas, Venezuela (10°24'N: 66°W); 12 h of photoperiod; 30°C day/ 16°C night and 81% RH.
- 2 Treatments: Well-Watered plants (WW) and drought plants (WD) at 60 DAS
- 4 Sampling dates Day 0 (SWC_{max}) → Day 3 → Day 5 (SWC_{min}) → Day 7

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