

Or_1.02: Precision phenotyping for improving drought stress tolerance maize in Thailand

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Introduction

Drought is a limiting factor in maize producing area in different part of the world. In Thailand, drought was reported as a priority constraint for maize production in many agro-ecological zones and it is observed almost every year (Eskasingh *et al.*, 2004). Maize is usually affected to drought stress at different stages. It is expected that breeding for drought tolerance genetic gains would be more rapid and predictable if desired morphological and physiological traits could be identified. The objective of the study was to compare the performance of early tropical hybrid maize and to understand the association of yield with morphological and physiological traits under water stress condition.

Methods

During the dry season of 2009, 148 early maturity hybrids from CIMMYT Mexico were introduced to Nakhon Sawan Field Crops Research Center (NSFCRC). Those materials were evaluated in separate trials under well-watered (WW) and severe water stress (SS) during flowering. Using Nakhon Sawan 2 (NS2) and Nakhon Sawan 3 (NS3) maize hybrids as local checks, treatments were arranged in 10 x 15 Alpha lattice design with three replications. Individual plots consisted of two rows, 5.0 m long with a row spacing 0.75 m and 0.20 m between plants. Observations on morphological and physiological traits and analyses of variance were performed using MSTAT procedure.

Results

Grain yield (GY) under SS ranged from 105 to 5,087 kg ha⁻¹ and anthesis-silking interval (ASI) ranged from -1 to 18 days. Number of ears per plant (EPP) ranged from 0.1 to 1.0. Hundred kernels weigh (HKW) ranged from 12.41 to 31.76 g. Mean Chlorophyll content (CHE) averaged 41.9 g/cm². Mean vegetative indices (NDVI) averaged 0.550. Stomatal conductance (LP) averaged 71.2 mmol/H₂O m⁻²s⁻¹. And infrared thermometer averaged (IR) 34.2 C° (Table 1). GY correlate positively

Table 1. Important agronomic and secondary traits of maize under severe stress condition at Takfa, 2009D

Traits	Min	Max	Mean
Tass	52	62	56 ± 1.59
Silk	53	75	61 ± 4.12
ASI	-1	18	5 ± 3.11
GY(kg ha ⁻¹)	105	5,087	2,591 ± 972.49
EPP	0.1	1.0	0.7 ± 0.16
HKW	12.41	31.76	25.82 ± 2.79
LRO	1	5	4 ± 0.68
CHE	27.8	53.9	41.9 ± 4.91
NDVI	0.400	0.660	0.555 ± 0.04
LP	0.1	182.1	71.2 ± 30.87
IR	31.5	37.7	34.2 ± 1.25

with EPP and HKW. The silking date (SD), leaf rolling (LRO) and ASI correlated negatively with GY. For physiological traits, CHE, NDVI, LP exhibited positive correlation with GY but IR correlated negatively with GY (Table 2).

Table 2 Phenotypic correlation coefficient (r) between grain yield and physiological traits under severe stress condition at Takfa, 2009D.

Traits	r
Silk	-0.2097*
ASI	-0.2745*
GY (kg/ha)	-0.5199*
EPP	0.2317*
HKW	0.2729*
LRO	-0.5072*
CHE	0.5531*
NDVI	0.3785*
LP	0.3572*
IR	-0.3635*

*Significant at 0.05 level of probability

Conclusions

Selection for drought tolerance, by increasing EPP, HKW, CHE, NDVI and LP were linked to higher yield under drought stress. In contrast, the reduction in ASI, LRO and IR suggesting that were increased higher yield.

References

Eskasingh, B.,P. Gypmantasiri, K. Thong-Ngam, and P. Grudloyma. 2004 Maize in Thailand : Production Systems, Constraints, and Research Priorities. Mexico, D.F.: CIMMYT. 36 pp