Foliar nutrients enhance physiological responses and yield of maize (*Zea mays* L.) under drought at tassel initiation

ID 641

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Introduction

- The demand for feed maize in Thailand has been increasing annually.
- Domestic feed maize production is insufficient to meet the demands of the livestock feed industry.
- The main problem in maize production is drought or dry spells caused by locations outside irrigated zones.
- Drought-induced reduction in maize yield
- This study aimed to evaluate the physiological responses and yield of maize following foliar applications of K, Ca, and Zn under drought stress conditions, before the critical tassel initiation stage.

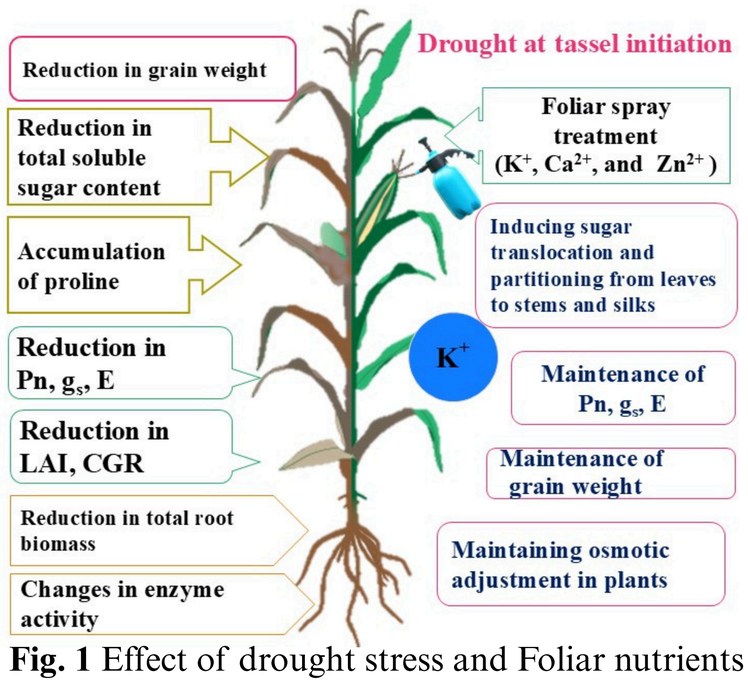


Fig. 1 Effect of drought stress and Foliar nutrients

Conclusion

- Foliar application of K^+ at 2 % and 4% effectively induced physiological responses in maize under drought conditions.
- Reduced the proline content in the silks
- Translocated and partitioned total soluble sugar content from leaves and stem to the silks
- Maintained net photosynthesis rate, stomatal conductance and transpiration rate
- These mechanisms helped maintain maize yield production under drought stress conditions.

Results

Table 1 Effect of foliar treatments before critical tassel initiation stage on Pn, g_s, and E under drought stress condition

Treatment	Net photosynthesis rate, PAR (umole m^{-2} s^{-1})	Stomatal conductance, g_s (mole H_2O m^{-2} s^{-1})	Transpiration rate, E (mmole H_2O m^{-2} s^{-1})
T1	22.364 a	0.059 a	3.825 a
T2	13.881 c	0.002 d	1.100 d
T3	20.862 a	0.054 a	3.407 a
T4	21.751 a	0.055 a	3.477 a
T5	18.908 ab	0.022 b	2.557 b
T6	15.389 bc	0.002 d	1.956 c
T7	6.854 d	0.008 c	1.780 c
T8	12.886 c	0.007 cd	1.810 c
Mean	**16.612**	**0.026**	**2.489**
$LSD_{0.05}$	**1.877***	**0.0026***	**0.206***
%CV	**15.98**	**14.35**	**11.70**

Notes: *: significantly different at p<0.05, a, b, c, d, e and f compared with LSD (P<0.05)

Table 2 The Pearson correlation coefficient between yield and physiological responses under drought conditions

	Grain yield	Pn	g_s	E	TSCK
Pn	ns				
g_s	ns	0.693*			
E	ns	0.767*	0.880*		
TSCK	0.414*	0.360*	0.776*	0.748*	
POK	-0.464*	-0.368*	-0.488*	-0.601*	-0.500*

Notes: *: Significant difference and ns: not significant difference in correlation of physiological response, and yield, at significance level p < 0.05

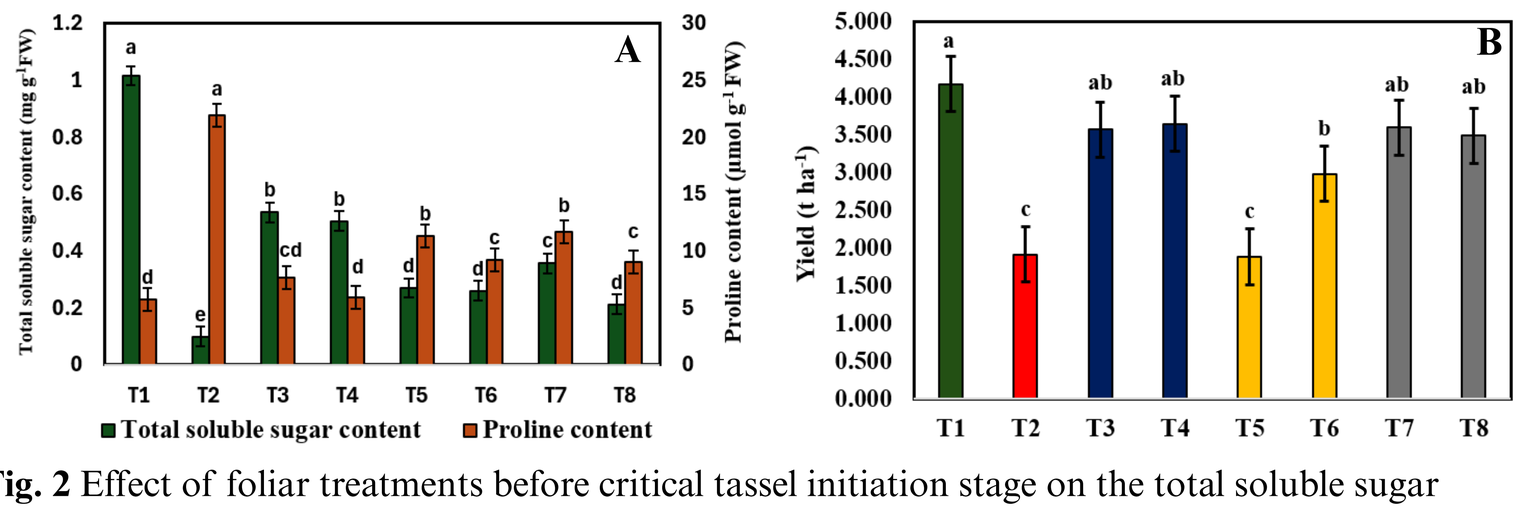


Fig. 2 Effect of foliar treatments before critical tassel initiation stage on the total soluble sugar content and proline content of silks (A), yield (B) under drought condition

Notes: Error bars = ± SD and mean values with different superscript letters within each column denote significant ($p < 0.05$) differences between groups (LSD)

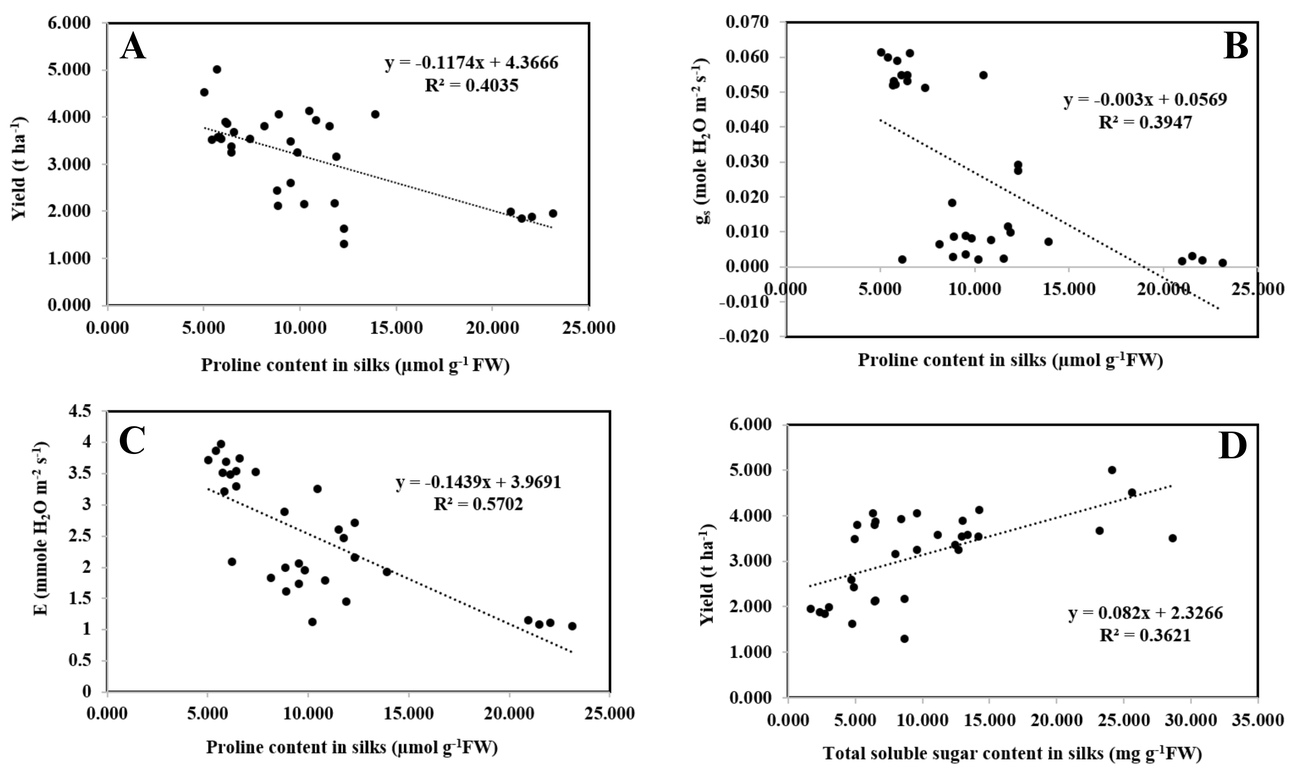
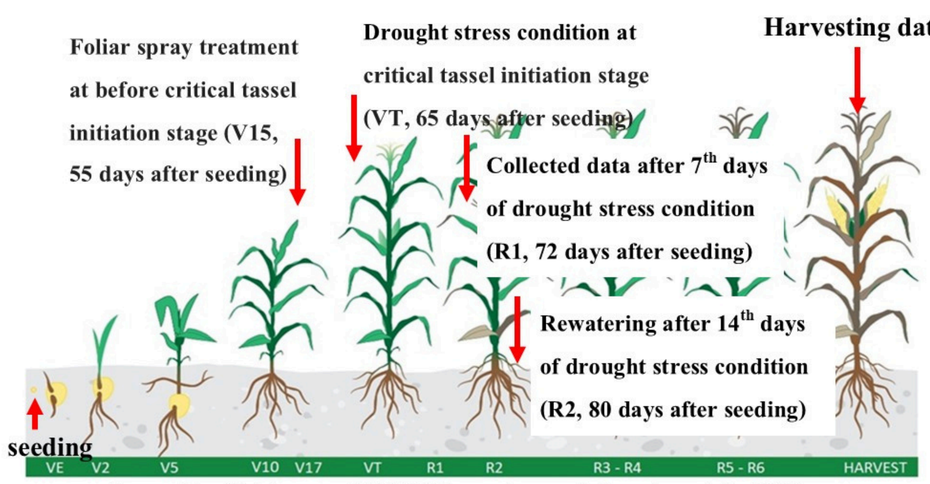


Fig. 3 The correlation of proline of silks with yield (A), stomatal conductance (g_s) (B), and transpiration rate (E) (C), the correlation of sugar of silks with yield (D)

Materials and Methods



Source: https://datadragon.eu/2019/03/25/syngenta-crop-challenge-in-analytics-2019/

Fig. 4 The experimental procedure under maize developmental stages

- **The experimental design**
  - Randomized complete block design (RCBD) with 4 replications
  - **T1:** Well-watered control, **T2:** Drought stress at tassel initiation, **T3–T4**: Foliar K^+ at 2 % and 4%, **T5–T6:** Foliar Ca^{2+} at 0.1 % and 0.2%, and **T7–T8:** Foliar Zn^{2+} at 0.3 % and 0.6 % at the critical tassel initiation stage under drought conditions.
- **The experimental data**
  - **Field trials:** Farmer field research of Syngenta Seed (Thailand) Co. Ltd., U-Thong district, Suphan Buri province, Thailand.
  - **Growing season:** May- August 2020, the average rainfall was 487 mm., with a drought condition of 58.83 mm. in August.
  - **Data collection:** Pn, E, and g_s (LI-COR 6400); total soluble sugar content (Anthrone method); proline content (Bates method) (Irigoyen et al., 1992); and yield

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