21ª CONFERENCIA INTERNACIONAL SOBRE PALMA DE ACEITE
21st International Oil Palm Conference

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MÓDULO 1

Characterization of Two Inward Shaker K+ Channels EgKAT1 and EgKAT2 in Oil Palm

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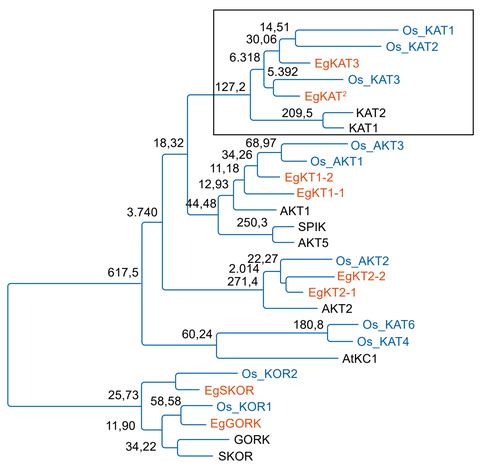
Context

- Potassium (K+) is a key factor for maintaining high yields in oil palms.
- K+ is transported by a large family of channels and transporters.
- Shaker channels are mainly responsible for not only long-distance flows in the plant.
- To maintain high yields while reducing K+ fertilization, it is necessary to understand the K+ transport mechanisms, in particular the Shaker channels.

>> Molecular and functional characterization of Shaker K+ channels in oil palm?

→ **Focus on two Shaker inward channels: EgKAT1 and EgKAT2**

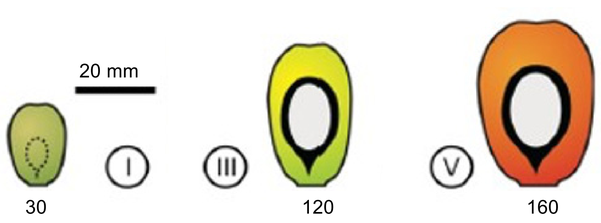


Phylogenetic relationships of Shaker Channels in Arabidopsis (black), Rice (blue) and oil palm (red). EgKAT sub family in black box (Monder *et al.,* 2022)

Genetic material

- 27 individuals Deli × La Mé planted in Presco, Nigeria.
  - → 3 stages of fruits development from adult palm : F1, F2, F3
- 102 individuals Deli × La Mé from greenhouse young plants.

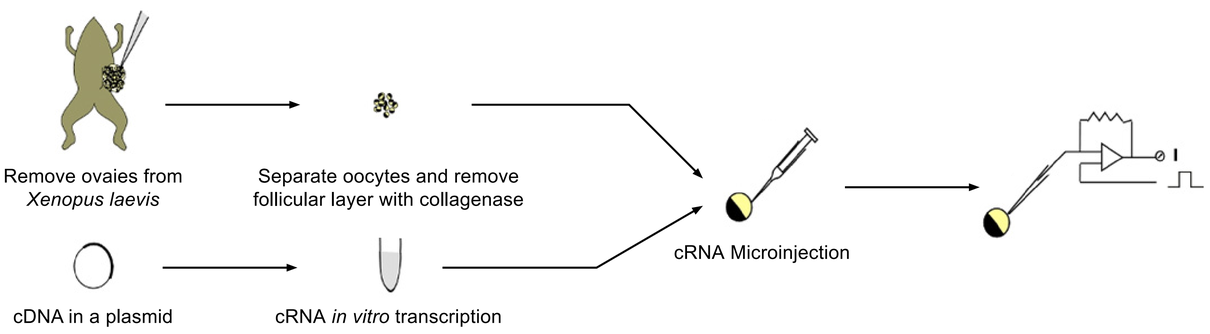
F1 (30 dap) young fruit | F2 (120 dap) mid-ripe fruit | F3 (160 dap) mature fruit



Adapted from Tranbarger *et al.,* 2011

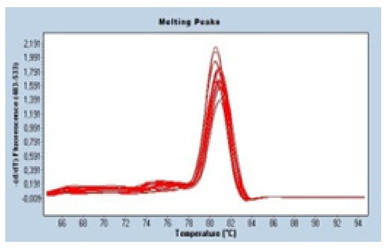
Electrophysiology

- Functional properties of EgKAT1 and EgKAT2 channels in *X. laevis* oocytes by voltage-clamp analyses.



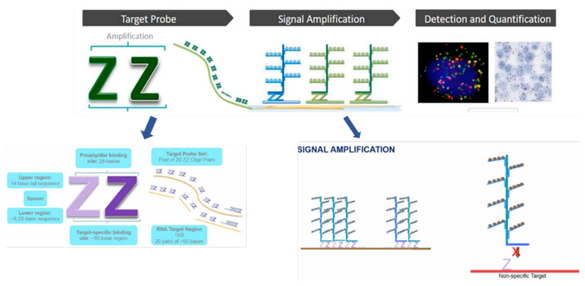
Expression by RT-qPCR

- Tubuline used as housekeeping gene.
- 3 biologicals replicates.
- 3 young tissues (leaf, meristem and root).
- 3 stages of fruit development.



Tissue localization by RNAscope

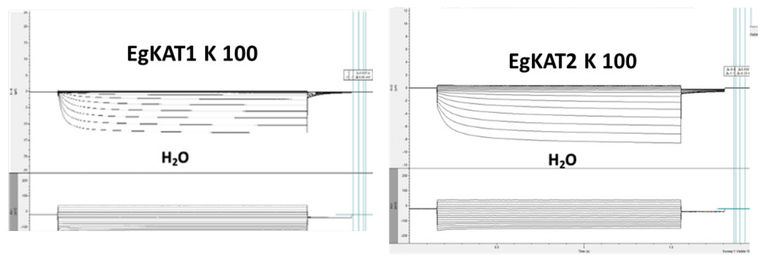
- New technology *in situ* hybridization for the detection of a single RNA molecule in oil palm tissues.
- (Solanki *et al.,* 2020; Bowling *et al.,* 2014 and Munganyinka *et al.,* 2018).
- Target Probe, signal amplification and chromogenic signal dot detection (RED) http://www.acdbio.com



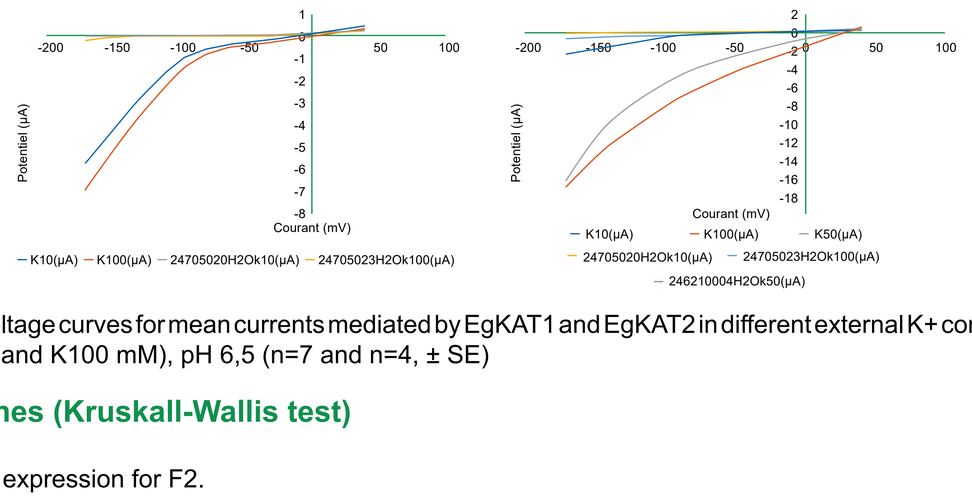
Results

EgKAT1 and EgKAT2 are inwardly rectifying channels with different kinetics.

EgKAT1 is activated more quickly.



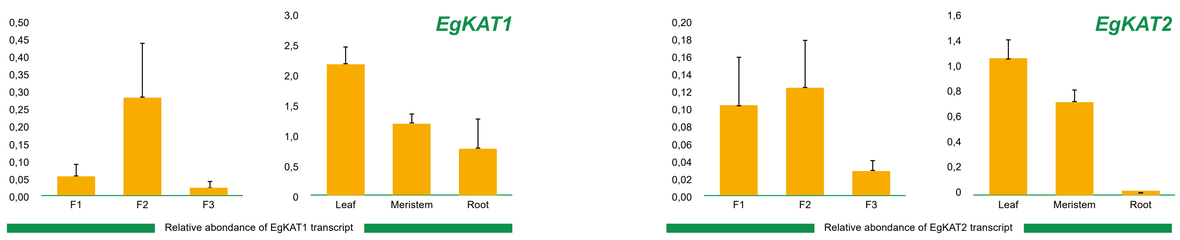
Response to voltage-pulses for oocytes injected with water as control or with EgKAT1 and EgKAT2 cRNA (6 ng).

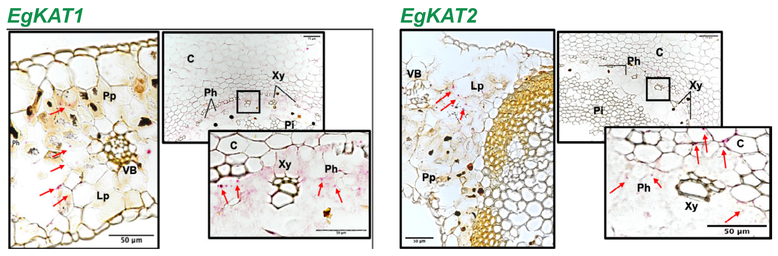


Current-voltage curves for mean currents mediated by EgKAT1 and EgKAT2 in different external K+ concentrations (K10, K50 and K100 mM), pH 6,5 (n=7 and n=4, ± SE)

For 2 genes (Kruskall-Wallis test)

- stronger expression for F2.
- stronger expression for leaves and meristems and weaker for roots in young plants.





Transcripts of *EgKAT1* and *EgKAT2* are localized

- in the phloem and cortex in roots.
- in the parenchyma (palisade and lacunar) cells of the young leaves.
- in the mesocarp cells of F2 fruits and meristem (data not shown).

C,cortex; Lp, Lacunar parenchym; Pp, Palisade parenchyma; Pi,pith; Ph, phloem; VB, vascular bundles; Xy, Xylem

Conclusions

- EgKAT1 and EgKAT2 mediated inward K+ uptake currents.
- These genes are expressed in the phloem and cortex in roots, indicating a role in K+ uptake from soil solution and parenchyma cells of the leaves suggesting their implication in photosynthesis.

→ **improved yield**

>>This work provides a better understanding of the potassium transport mechanism in oil palm and opens up new prospects for research aimed at reducing K+ fertilization.

Bibliographic references

Boccaccio, 2001, Thèse pp105; Solanki *et al.,* 2020, Plant Methods 16, 71; Bowling *et al.,* 2014, Appl. in Plant Sci., 2: 1400011; Monder *et al.,* 2022, SFBV. Sept., Munganyinka *et al.,* 2018, Virol J., 14;15(1):128; Tranbarger *et al.,* 2011, Plant Physiol 156, 564-584

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