Characterising a potential genetic marker, VviNPF2.1, for grapevine salt exclusion

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Introduction

Salinity is caused by high sodium (Na⁺) and chloride (Cl⁻) concentrations in soils and irrigation water.

Effects of excessive salt on grapevines include:
- Reduced vine water uptake²
- Hyper-accumulation of Na⁺ and Cl⁻ ions in vines, causing toxicity symptoms²
- Reduced yield and grape berry quality¹

Vitis vinifera NPF2.1, a gene in the Nitrate/Peptide transporter Family, is significantly more highly expressed in the good Cl⁻ excluding rootstock 140 Ruggeri than in the poor Cl⁻ excluder K51-40³.

Aims

Functionally characterise VviNPF2.1 to determine its role in conferring Cl⁻ exclusion to grapevine shoots.

Develop VviNPF2.1 as a new genetic marker for salt excluding rootstock breeding.

Subcellular localisation

Method:

Expression of a yellow fluorescent fusion protein with VviNPF2.1 in Arabidopsis thaliana mesophyll protoplasts showed that VviNPF2.1 is localised to the plasma membrane.

Results: plasma membrane

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PM marker

Chloroplast

VviNPF2.1

Transmitted

Merged

Conclusions

VviNPF2.1 localises to the plasma membrane

VviNPF2.1 transports Cl⁻

It may have a direct role in ion transport in grapevine roots

It may be a Cl⁻ transporter directly involved in Cl⁻ transport in grapevine roots

Future questions

Does VviNPF2.1 exclude Cl⁻ from roots or prevent Cl⁻ from entering the root xylem?

- We will investigate in which part of the root VviNPF2.1 is more highly expressed. We will analyse the transcript abundance of VviNPF2.1 in stelar enriched and cortex enriched root portions, to determine how VviNPF2.1 participates in shoot Cl⁻ exclusion.

Functional assay: complement Arabidopsis NPF2 knockout mutants by overexpressing VviNPF2.1.

- Does VviNPF2.1 complement the AtNPF2 knockout mutant phenotype?

References


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