IDENTIFICATION OF BIOMARKERS LINKED TO DIFFERENT POTASSIUM FERTILIZER FORMS FOR OIL PALM

Ismail Zaag[1,2], Emmanuelle Lamade[2,3], Jean-Pierre Caliman[4], Guillaume Tcherkez[1,3]

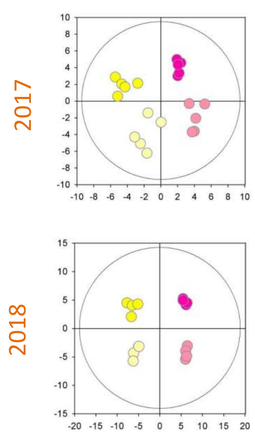
1. Institut de recherche en horticulture et semences, UMR 1345 INRAE, Université d'Angers, 42 rue Georges Morel, 49070 Beaucouzé, France
2. CIRAD, unité Absys, 2 place Viala - Bâtiment 27, Montpellier, France
3. Research school of biology, Australian National University, 2601 Canberra ACT, Australia
4. SMART Research Institute, Sinar Mas Agroresources and technology Tbk, Libo Mill, Kandis, Riau, Indonesia

Introduction

This study explores the metabolic response of two oil palm clones to various potassium sources, aiming to identify metabolomic markers that universally indicate potassium levels, related to/regardless of fertilizer type. Additionally, we examine nutrient interactions and their effects on potassium fertilization.

A recent field study examined the metabolomic response of oil palm to potassium (K) availability in two crosses (Deli x La Mé and Deli x Yangambi), using potassium chloride (KCl) as the potassium source.

Output of the multivariate analysis of metabolome: score plots of the O2PLS analyses using K and cross as predicted Y variables



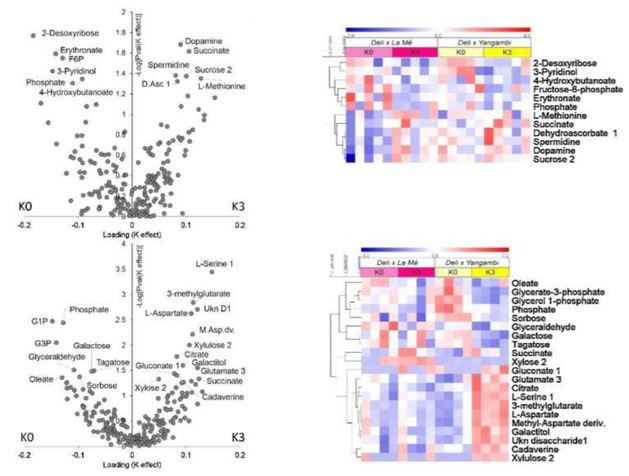
208 analytes were quantified and identified in 2017.

181 analytes were quantified and identified in 2018.

Data source : Cathleen Mirande-Ney PhD, Paris Sud 2020

Volcano plots associated with the effect of K availability

Heatmaps of metabolites significant for the K effect



12 analytes were significant for the K effect

21 analytes were significant for the K effect

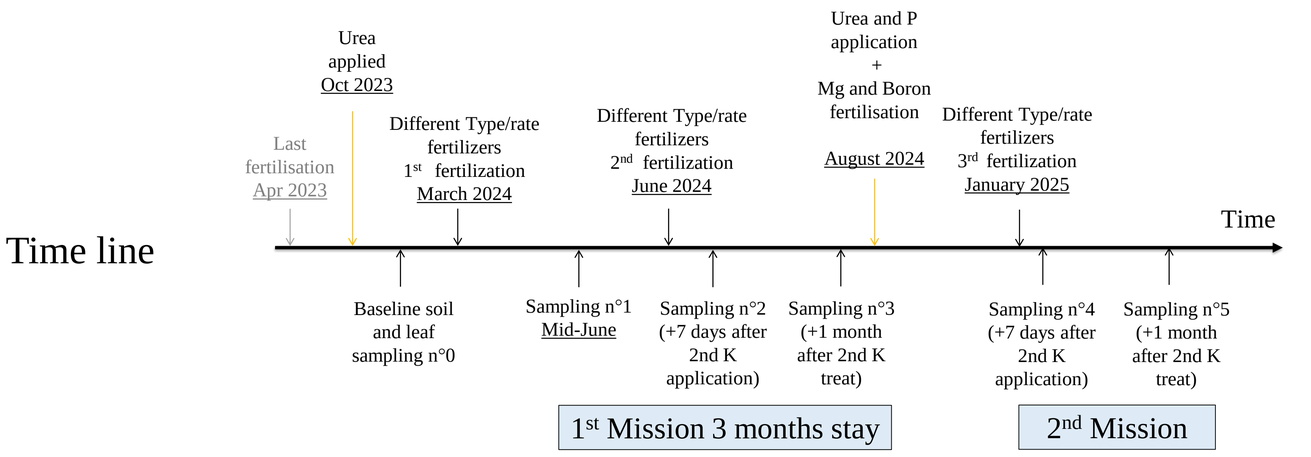
The results showed that only one to two years after the start of K fertilization treatments, changes were observed in nitrogen metabolism, photosynthesis, and mitochondrial metabolism, with differential effects between the two crosses.

Some metabolites could be affected by K content and thus <u>their analysis could be helpful to monitor oil palm K status</u>

Metabolomic patterns of oil palm leaves under two K fertilization treatments.

Material and methods

I. Field Sampling



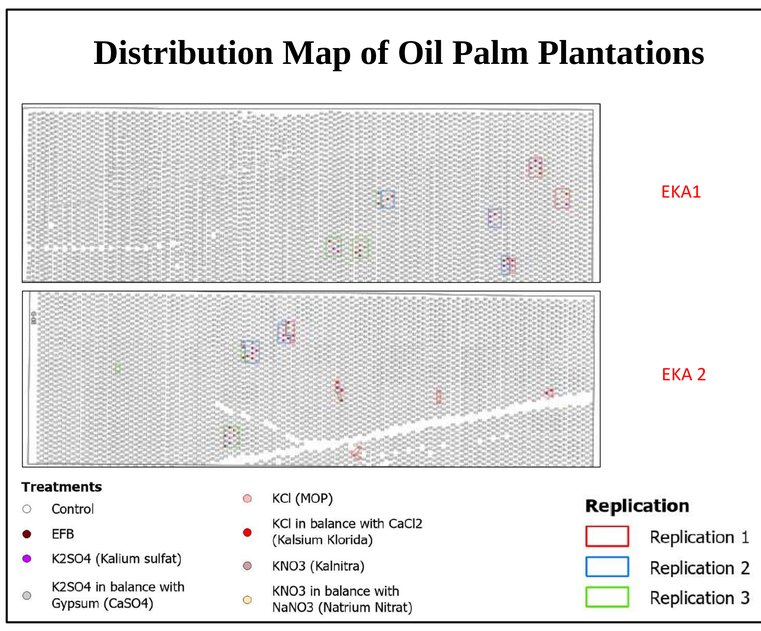
Fertilizer	Formula	%K_2O
Potassium chloride	KCl	60%
Potassium sulfate	K_2SO_4	50%
Potassium nitrate	KNO_3	46%

7 K Treatments
KCl in balance with $CaCl_2$
K_2SO_4 in balance with gypsum
KNO_3 in balance with $NaNO_3$
Empty Fruit bunches

63 Trees (3 K levels (K1/K2/K3) *3*7 treatments) + 3 K0 = 66 trees per clone

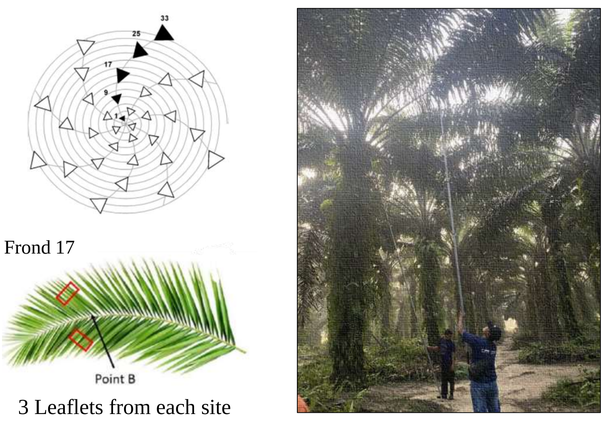
Sumatra, Pt Smart, Palapa Estate

Distribution Map of Oil Palm Plantations



Sampling

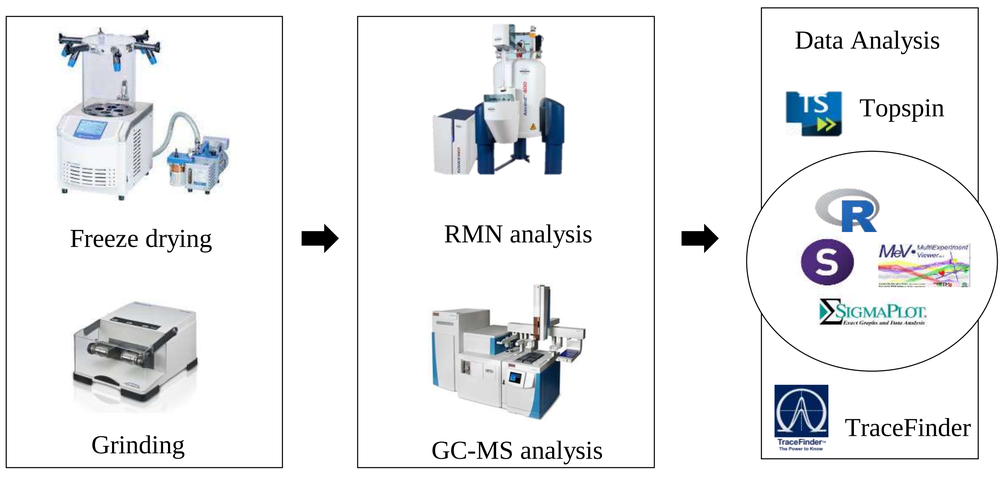
Leaflets were sampled on leaf rank number 17 at point B



3 Leaflets from each site

II. Lab Analysis

Metabolomics analysis



Elemental analysis

The following elements will be measured: nitrogen (N), foliar phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sodium (Na)…

Anions such as nitrate (NO_3^-), chloride (Cl^-), phosphate (PO_4^{3-}), and sulfate (SO_4^{2-}) will be analyzed by high-performance liquid chromatography (HPLC).

ICP-MS

ICP-AES

HPLC