Agroscope Bioinformatic Network Symposium
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ANALYSIS OF ROOT EXUDATES TO STUDY INTRA- AND INTERSPECIFIC BELOWGROUND INTERACTIONS OF COVER CROPS

Çağla Görkem Eroğlu

Herbology in Field Crops

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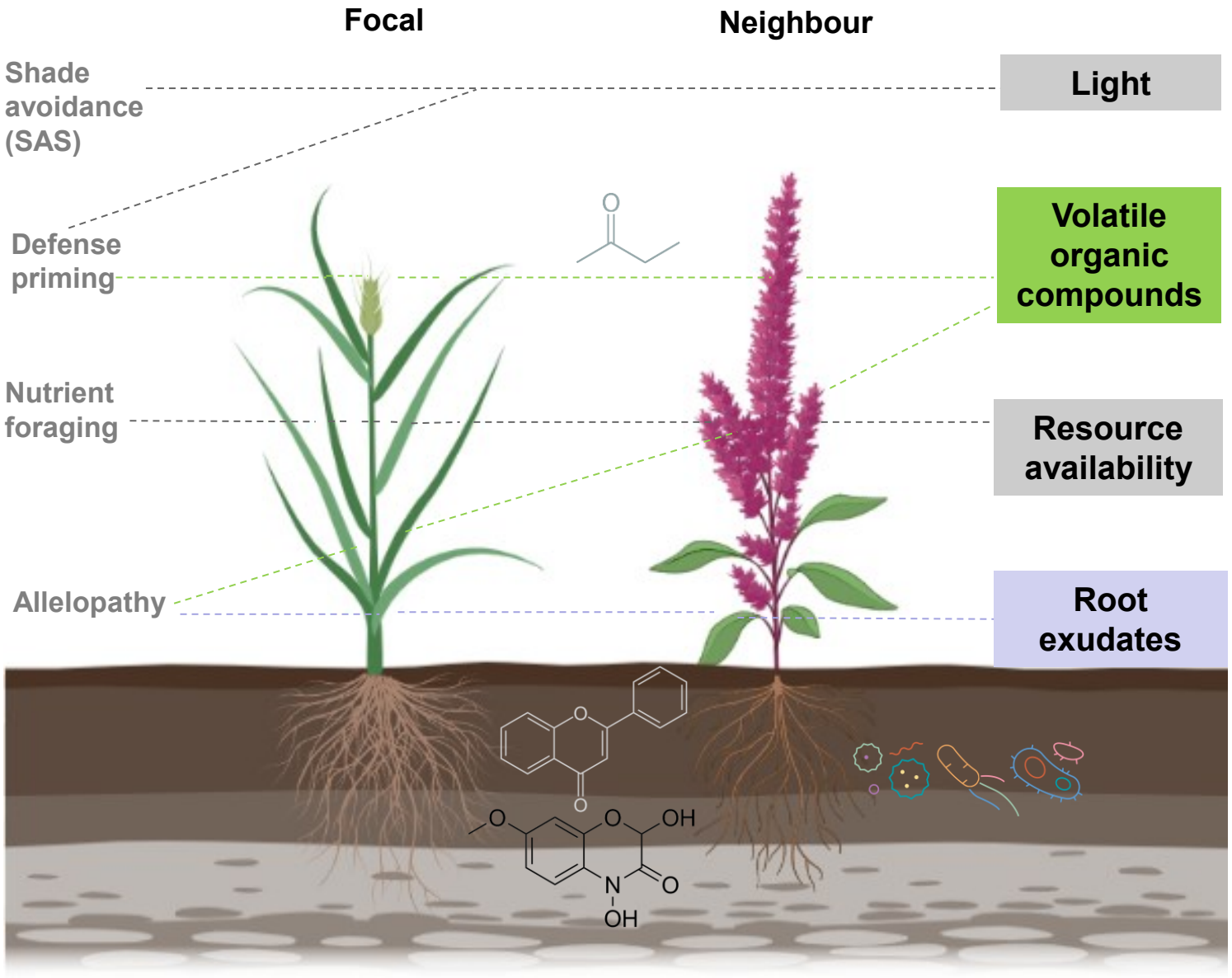
Focal
Neighbour
Shade avoidance (SAS)
Light
Defense priming
Volatile organic compounds
Nutrient foraging
Resource availability
Allelopathy
Root exudates
O
O
O
OH
N
O
OH

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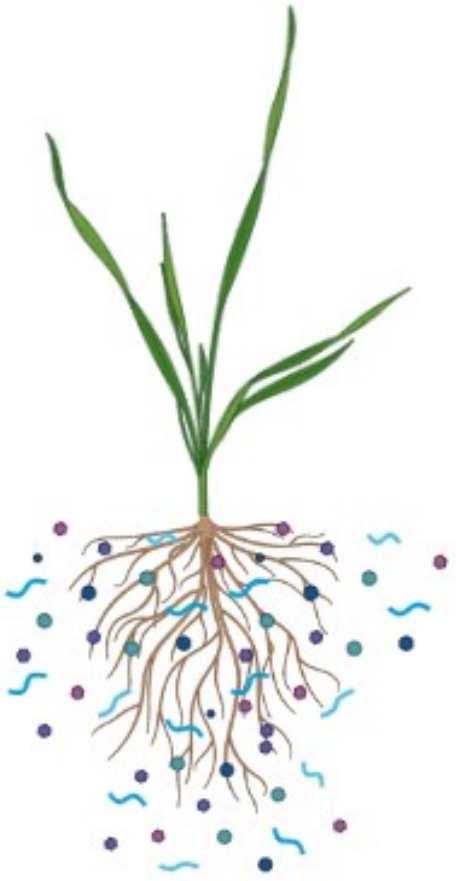
Root Exudates

Primary metabolites

- Amino acids
- Sugars
- Organic acids



Secondary metabolites

Phenolic compounds (simple phenolics, flavonoids, coumarins)
Terpenoids (monoterpenes, sesquiterpenes, diterpenes)
N containing compounds (Benzoxazinoids)

Chemical Factors
phytohormones, trace elements, nutrient concentration)

Biological factors
Fungi, bacteria, herbivores, neighbour plants

Physical factors
Light, osmotic stress, available water, temperature

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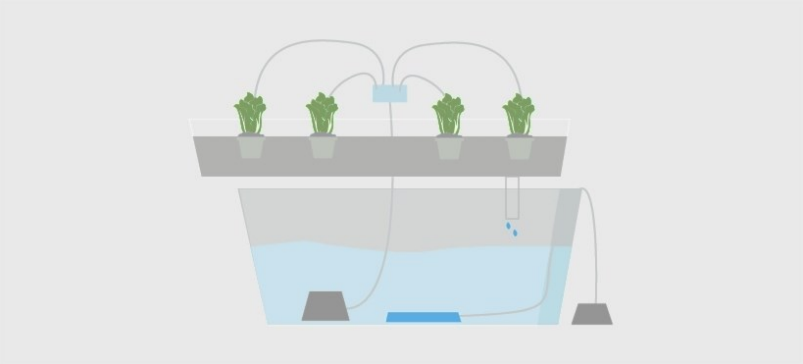
Why and how we study root exudates?

- Crop yield reduction 34% weeds, 18% pests and 16% pathogens
- Prevent weed germination and growth
- Herbicide resistance, environmental and health concerns
- Greener agriculture, enhanced phytoremediation

1) Hydroponics or *in-vitro* growth conditions
2) Soil or solid-matrix growth



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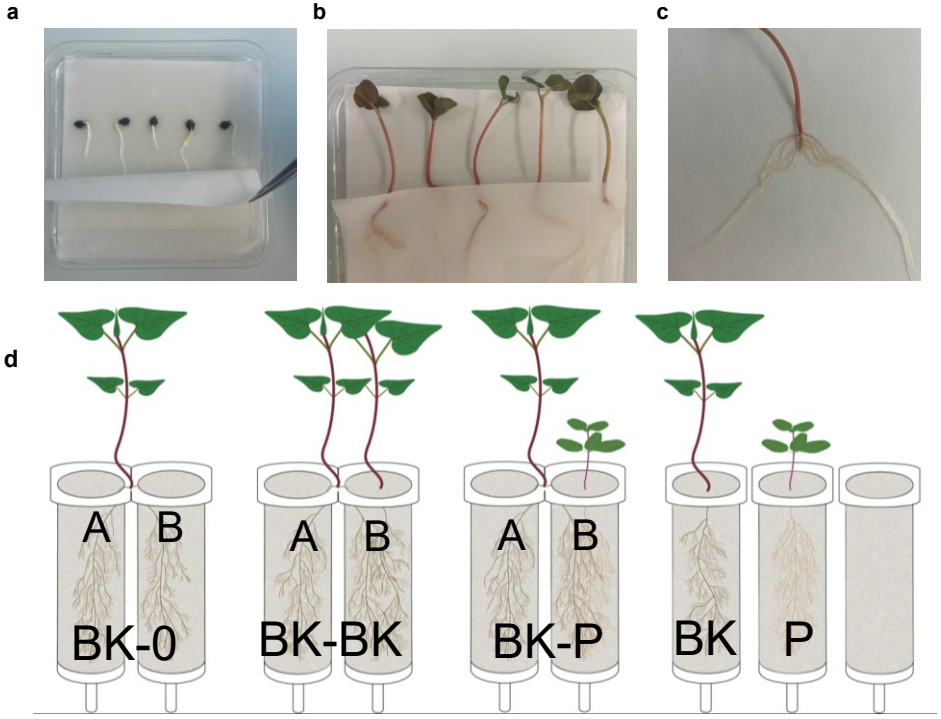
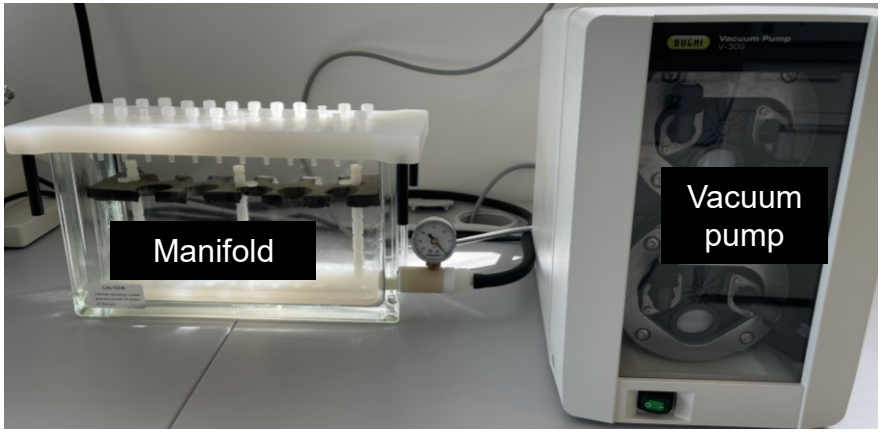
Split root system



BK: Buckwheat, **P=** Pigweed

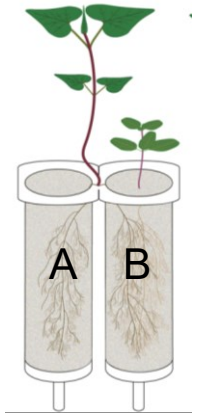
Pre-germination in Petri dishes 7 days (BK), 5 days (BO)
250-400 µ glass beads, 5 mL of ½ HG per day, 2 weeks in split root systems

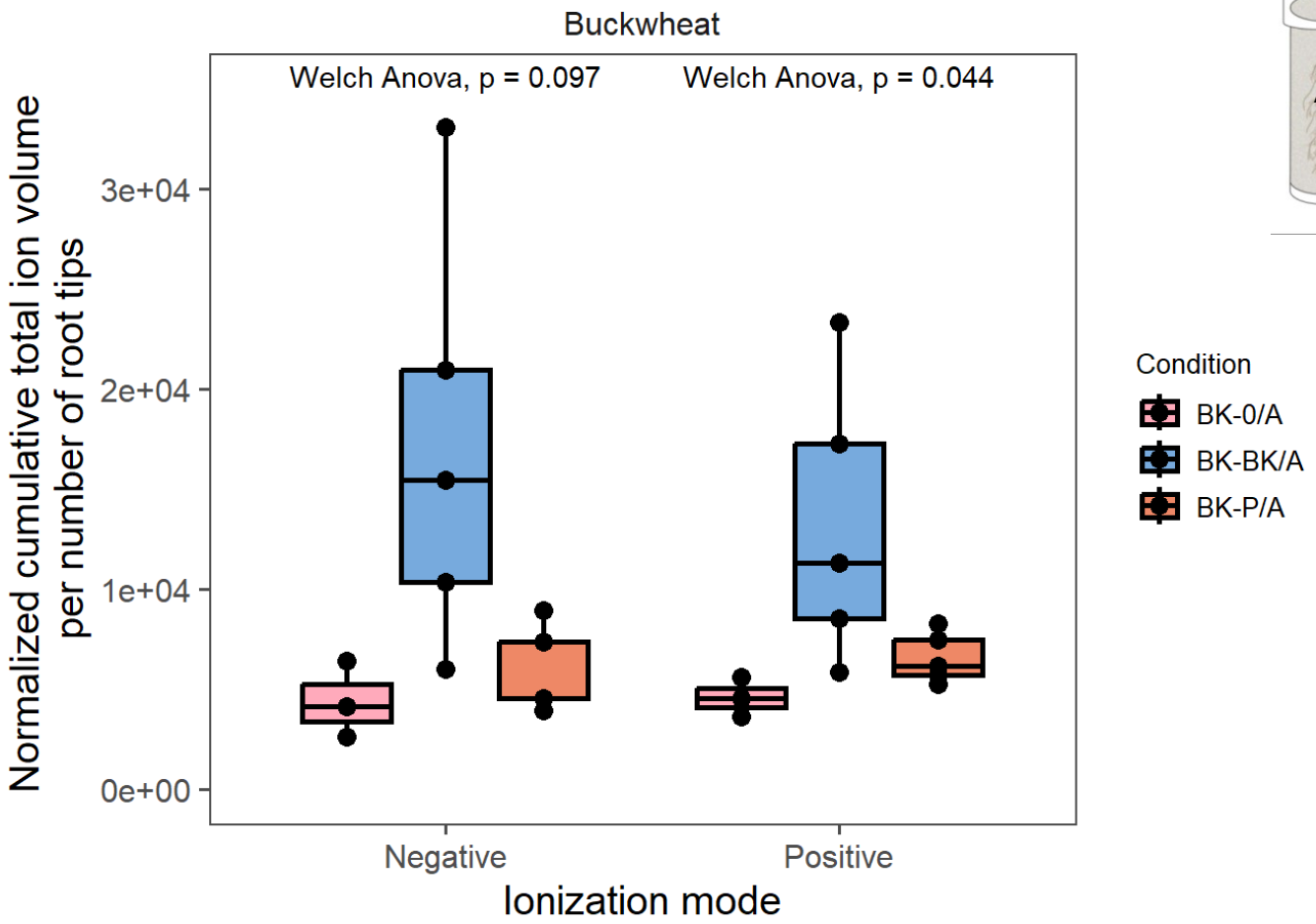
Root Exudate Collection and LC-MS Analysis



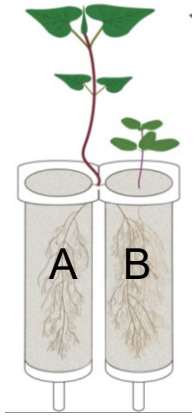
Extraction solution: $CH_3OH/CH_2O_2/H_2O$ (v/v/v)(95:5:0.05)
Internal Standard: 3,5-Di-tert-butyl-4-hydroxybenzoic acid

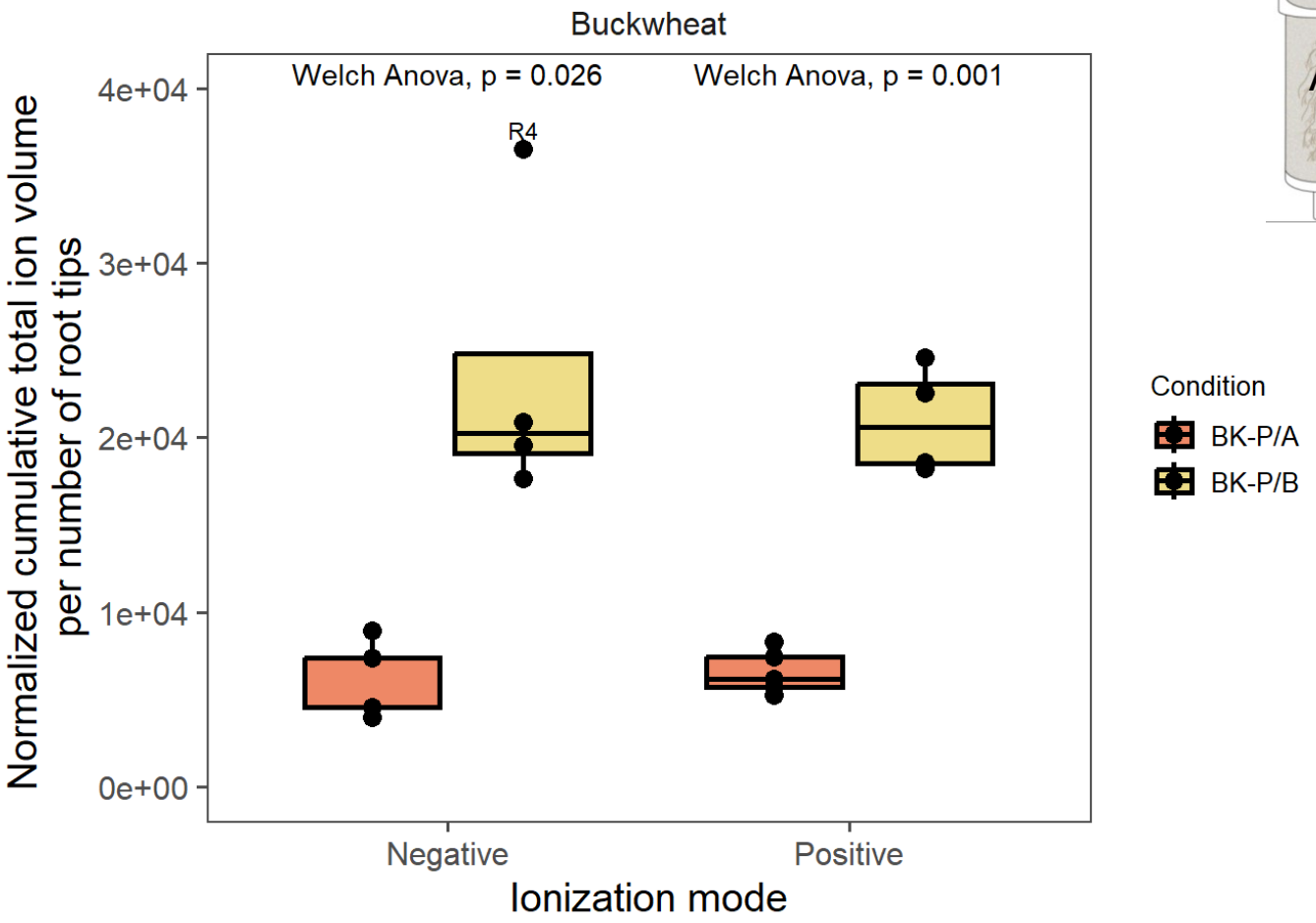
BK A compartments



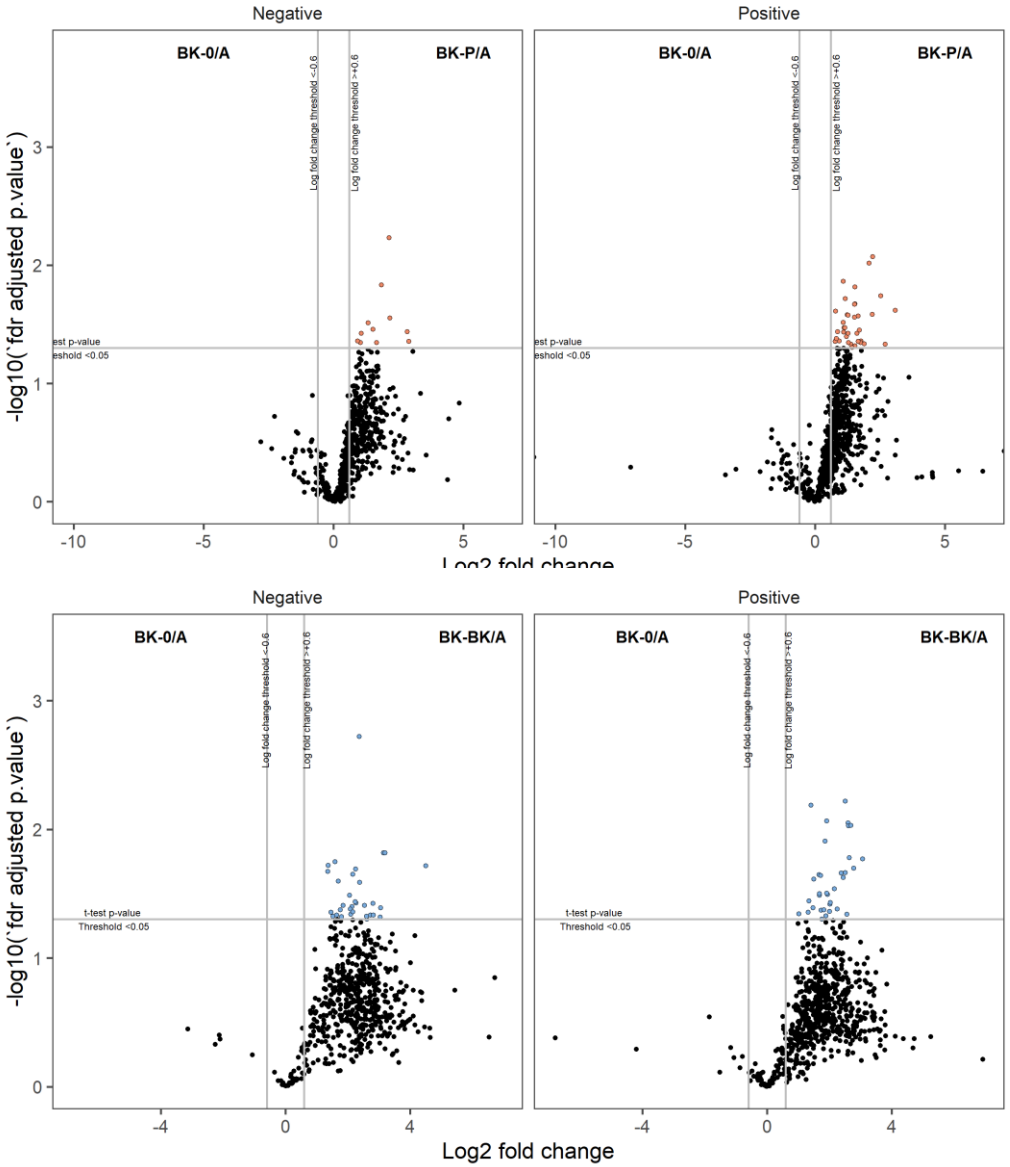


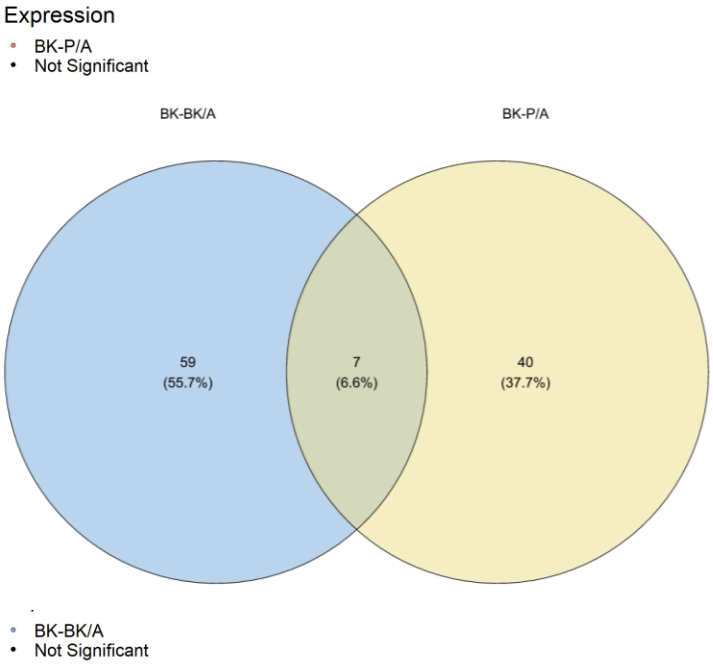
BK-P/A vs. BK-P/B





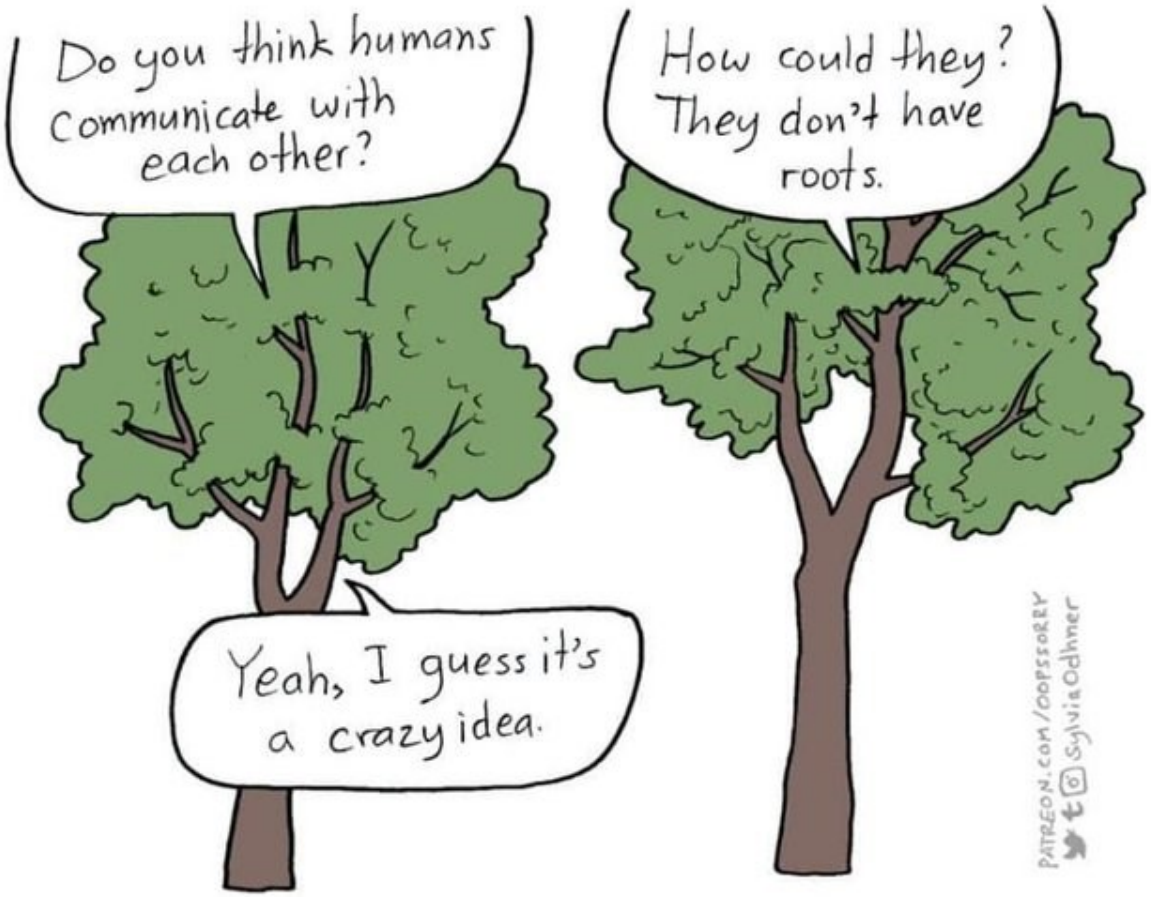
LC-MS Analysis of Root Exudates





Take-home message

- The presence of neighbors via interacting root systems leads to a systemic modification of cover crop root exudation
- Depending on the both cover crop and neighbour identity interaction dynamics change



thank you!

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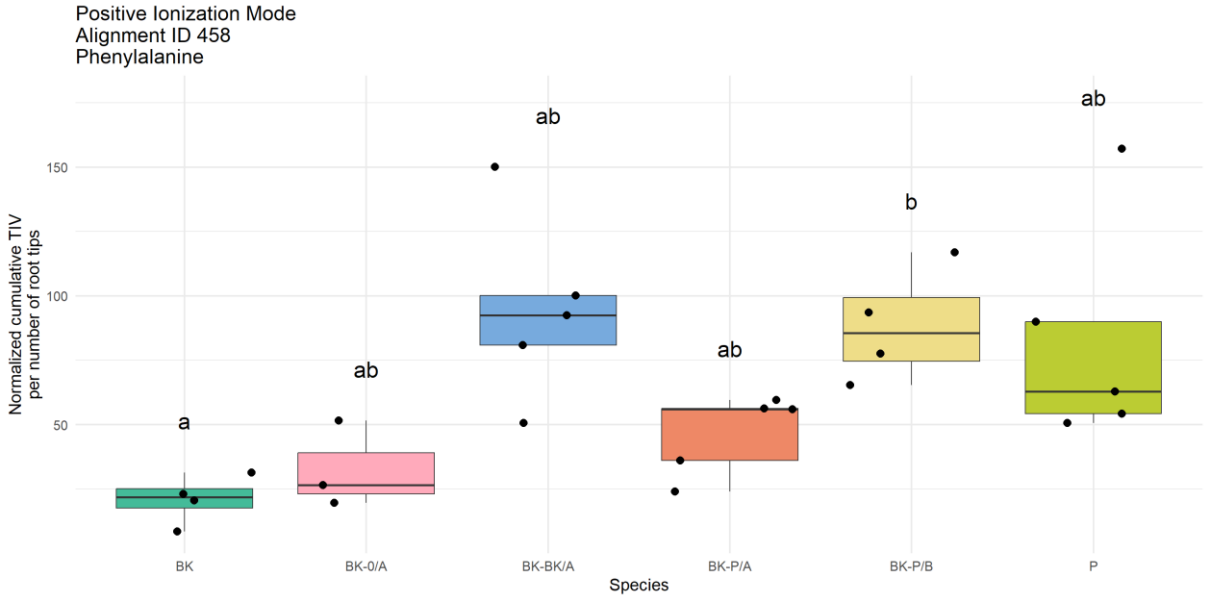
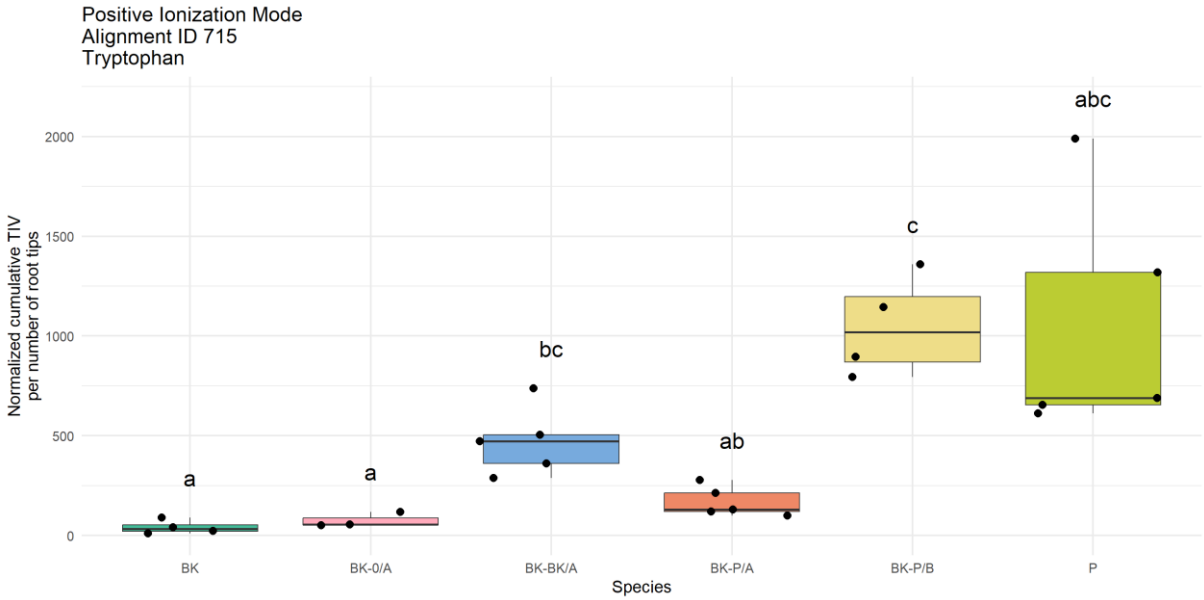
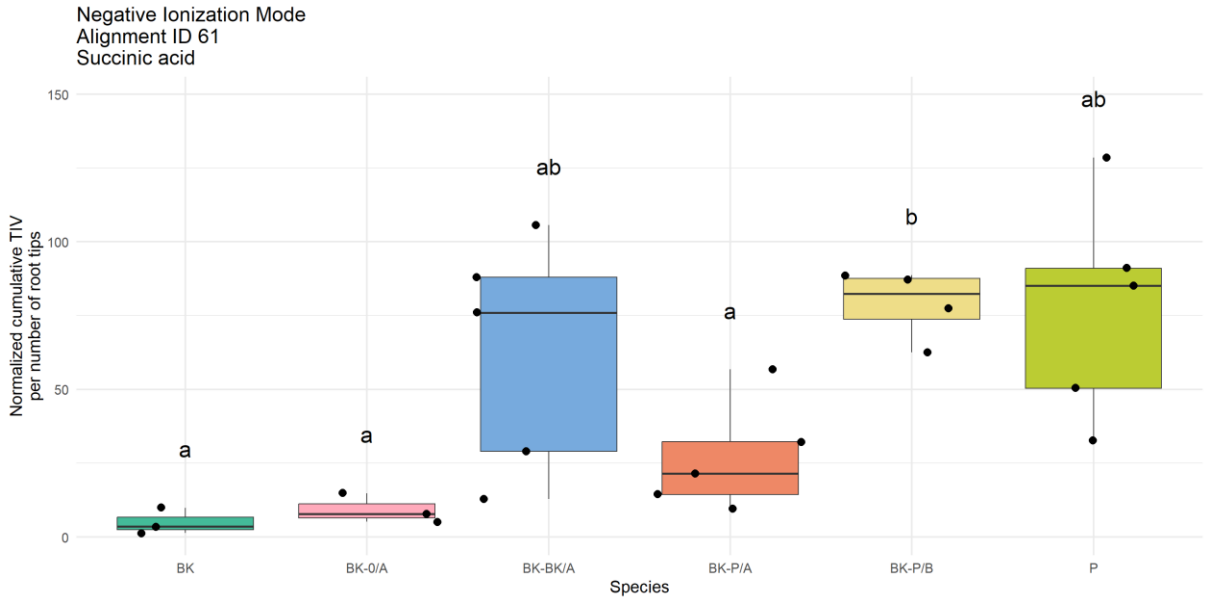
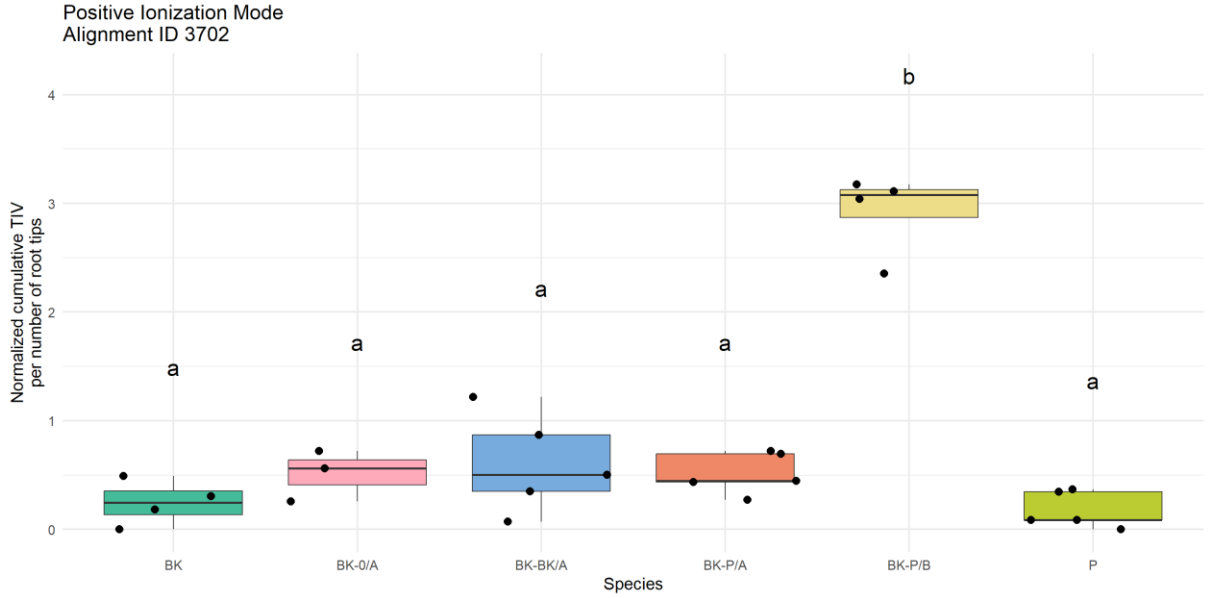
SCHWEIZERISCHER NATIONALFONDS
FONDO NAZIONALE SVIZZERO
SWISS NATIONAL SCIENCE FOUNDATION

BOKU


Positive Ionization Mode
Alignment ID 458
Phenylalanine
Normalized cumulative TIV
per number of root tips
150
100
50
a
ab
ab
ab
b
ab
BK
BK-0/A
BK-BK/A
BK-P/A
BK-P/B
P
Species


Positive Ionization Mode
Alignment ID 715
Tryptophan
Normalized cumulative TIV
per number of root tips
2000
1500
1000
500
0
a
a
bc
ab
c
abc
BK
BK-0/A
BK-BK/A
BK-P/A
BK-P/B
P
Species


Negative Ionization Mode
Alignment ID 61
Succinic acid
Normalized cumulative TIV per number of root tips
150
100
50
0
a
a
ab
a
b
ab
BK
BK-0/A
BK-BK/A
BK-P/A
BK-P/B
P
Species


Positive Ionization Mode
Alignment ID 3702
Normalized cumulative TIV per number of root tips
4
3
2
1
0
a
a
a
a
b
a
BK
BK-0/A
BK-BK/A
BK-P/A
BK-P/B
P
Species