

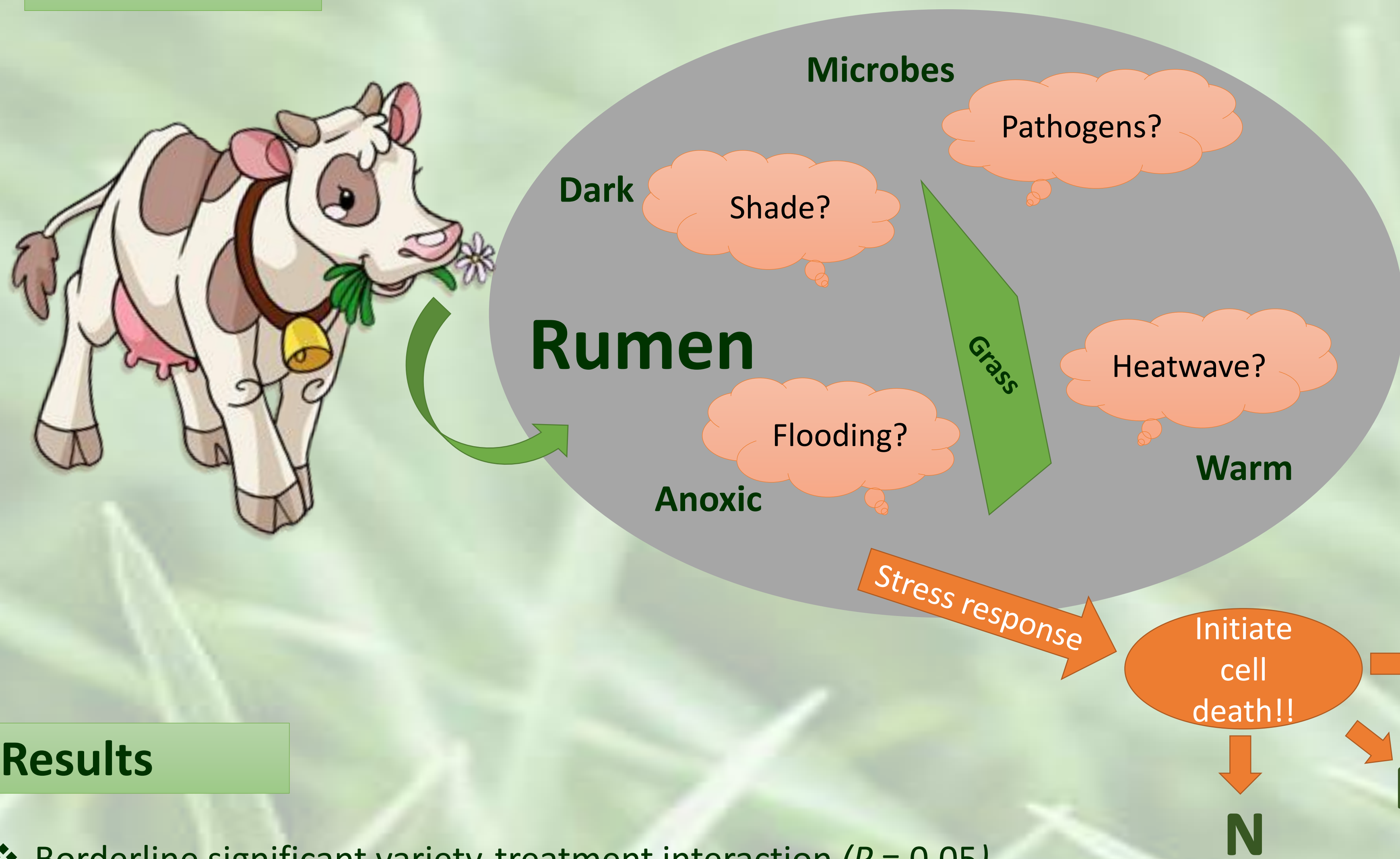


The VOC Signature of Ryegrass Subjected to Environmental and Rumen Stress

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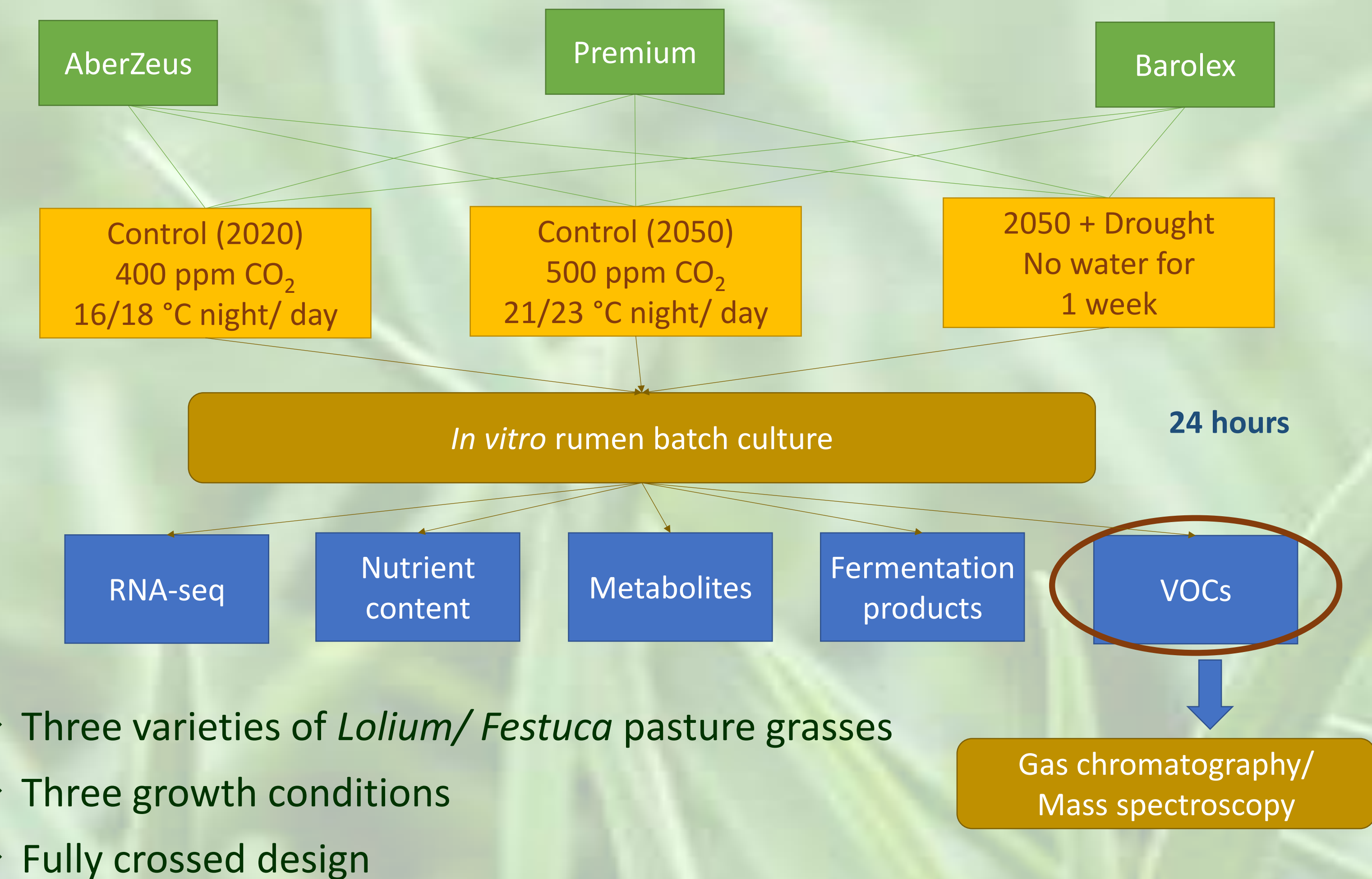
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Introduction



- ❖ For grass, being eaten by ruminants is stressful!¹
- ❖ Grass stress responses lead to proteolysis. Where N-compound production exceeds assimilation by rumen bacteria, N is excreted². This is bad for the environment.
- ❖ Climate change is stressful for grass too!
- ❖ Stressed plants alter their emission of volatile organic compounds (VOCs)³
- ❖ Does climate change stress affect how grass responds to the rumen stress?
- ❖ Can that be detected using VOCs?

Methods



- ❖ Three varieties of *Lolium/ Festuca* pasture grasses
- ❖ Three growth conditions
- ❖ Fully crossed design

Results

- ❖ Borderline significant variety-treatment interaction ($P = 0.05$)
- ❖ Significant effects of treatment ($P < 0.01$) and variety ($P < 0.01$)

Table 1. Classification success of Random Forests™ in assigning VOC profiles to the correct group. All runs were based on 5000 trees. Grass varieties could be classified correctly for >50% of samples. Pre-harvest conditions could be classified correctly for >60% of samples. Taking the most informative compounds (10 for variety, 14 for condition) and building new Random Forests™ improved the classification in both cases.

Group	No. correct	Error rate	No. correct (reduced)	Error rate (reduced)
AberZeus	6/9	0.33	7/9	0.22
Barolex	5/9	0.44	6/9	0.33
Premium	5/9	0.44	5/9	0.44
Control 2020	6/9	0.33	8/9	0.11
Control 2050	6/9	0.33	7/9	0.22
Drought	9/9	0	9/9	0

Fig 1. MDS ordination of VOC profiles of pasture grasses exposed to rumen fluid, based on proximity values from Random Forest™. (a) No discrimination by grass variety; (b) Partial discrimination by grass variety with reduced panel of compounds; (c) Partial discrimination by pre-harvest condition; (d) Partial discrimination by pre-harvest condition with reduced panel of compounds.

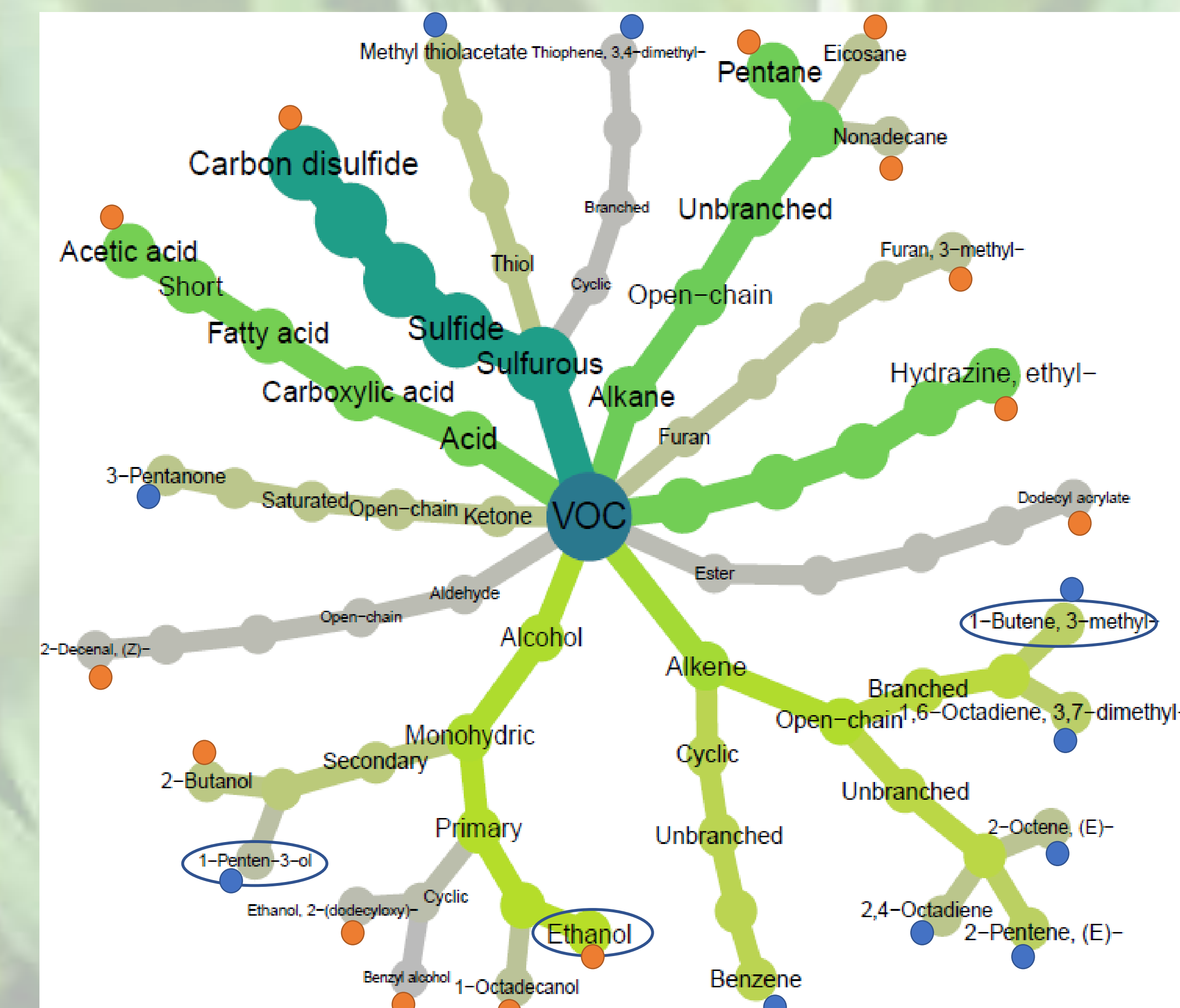
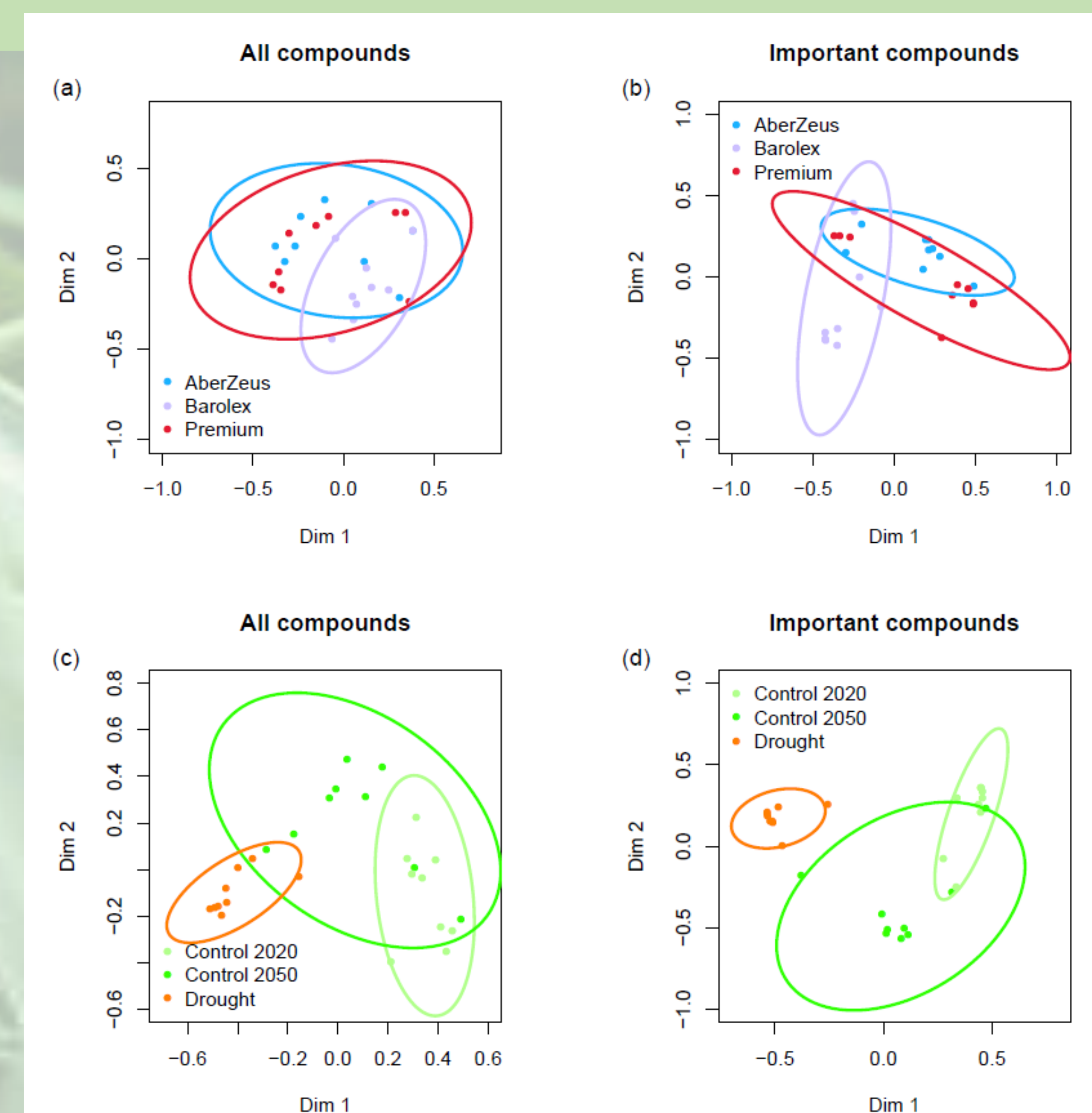


Fig 2. Hierarchical classification of compounds important in Random Forest™ classification. Node size and colour represent total abundance. Abundance is on an arbitrary scale where each sample sums to 100. Nodes marked with a blue dot were important for discriminating varieties; orange dot indicate importance for discriminating growth conditions. Compounds circled in blue have a known role in plant stress responses.

Conclusions

- ❖ All pre-harvest conditions alter VOC composition
- ❖ Differences between varieties were subtler but could be distinguished.