Impact of application of foliar fungicide on ensiling properties, feed value and core microbiome of barley silage

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Foliar fungal diseases of barley

Scald - *Rhynchosporium commune*

Net blotch - *Pyrenophora teres*

Net form

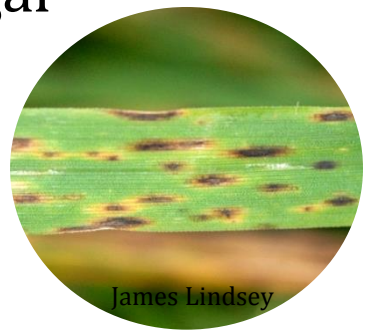
Spot form

Spot blotch - *Cochliobolus sativus*

Leaf rust - *Puccinia hordei*

Lignification and leaf shedding as a result of fungal infestation

Nutritive value and digestibility of barley



Introduction nd Methods Discussion nclusion

Foliar fungicides

Protect crop canopy
Decrease lignification
Increased grain fill
Improved nutritive value

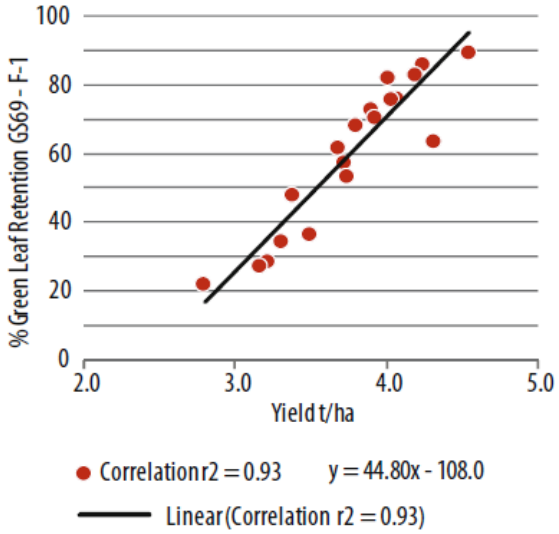
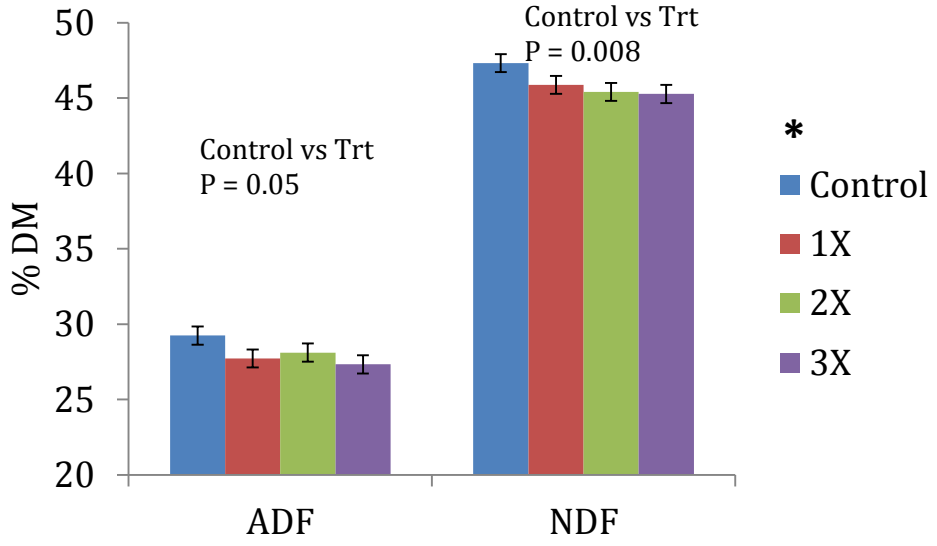


Figure 1: Effect of green leaf retention on barley yield
Poole 2009



Haerr et al. (2015)
*
Corn silage
1, 2 and 3 times fungicide applications

Figure 2: Effect of fungicide application on ADF and NDF content of corn silage

Hypothesis

Foliar fungicide application will increase barley silage quality and alter the bacterial and fungal core microbiome during ensiling and aerobic exposure relative to untreated barley

Objectives

Evaluate impact of foliar fungicide application on ensiling properties and feed value of barley silage

Evaluate impact of foliar fungicide application on bacterial and fungal core microbiome during ensiling and aerobic exposure

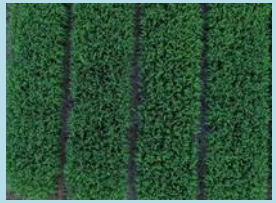
Lacombe

Fungicide sprayed (FSP)

Untreated (UN)

Lethbridge

Fungicide sprayed (FSP)



Untreated (UN)

In fungicide sprayed (FSP) treatments, fungicide Twinline® (BASF, Missisauga, ON) was applied at flag leaf emergence stage @ 0.5 L/ha while Untreated (UN)did not receive fungicide application

Harvested at mid-dough stage
Chop length – 9.5 mm theoretical chop length - Minisilos

Minisilo study

Triplicate minisilos per treatment
Sampled after 3, 7, 14, 21 and 60 d of ensiling

Aerobic stability

Triplicate samples from d 60 silage

2 thermal iButtons per container
for silage temperature

iButton for ambient temperature

Sampled after 3, 7, 14 and 21 d of
aerobic exposure

Chemical analysis

Samples of fresh forage, silage during ensiling and aerobically exposed silage

pH, VFA, lactic acid, ammonia, WSC

Samples of fresh forage, silage during ensiling

DM, CP, ADF, NDF, starch, ash

Microbial analysis

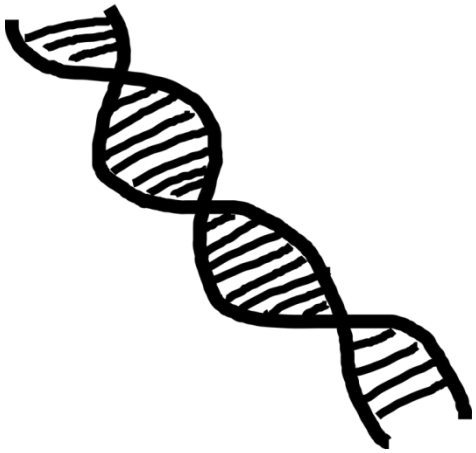
Samples of fresh forage, silage during ensiling and aerobically exposed silage

MRS medium – LAB

Nutrient agar – total bacteria

SDA medium – yeast and mold

DNA extraction



DNA extracted using FastDNA™ spin kit (MP Biomedicals)
DNA quantified using NanoDrop 3300

Sequencing

Illumina MiSeq
Analyzed by QIIME 1.9.1
Sequences clustered into OTUs

Statistical analysis

Mixed model procedure of SAS for repeated measure
- Ensiling parameters and microbial data

Parameters not significant for treatment × time analyzed as RCBD
- d0 and d60 of ensiling and d21 of aerobic exposure

GenomeQuébec

Results and Discussion

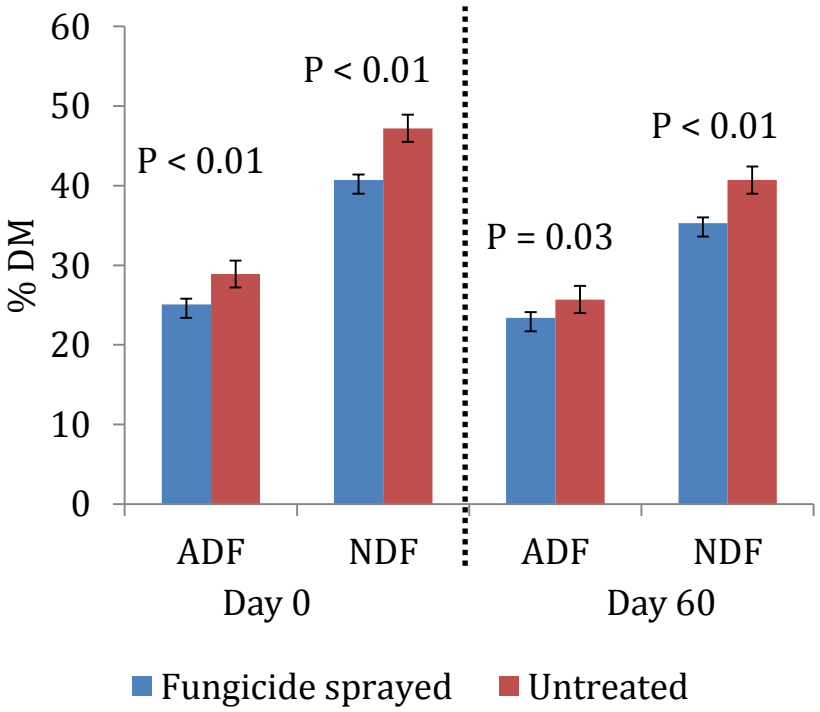


Figure 3: Effect of foliar fungicide application on ADF and NDF content of barley silage

Fungicide application decreased net blotch (P = 0.008)
(Turkington et al. personal communication)

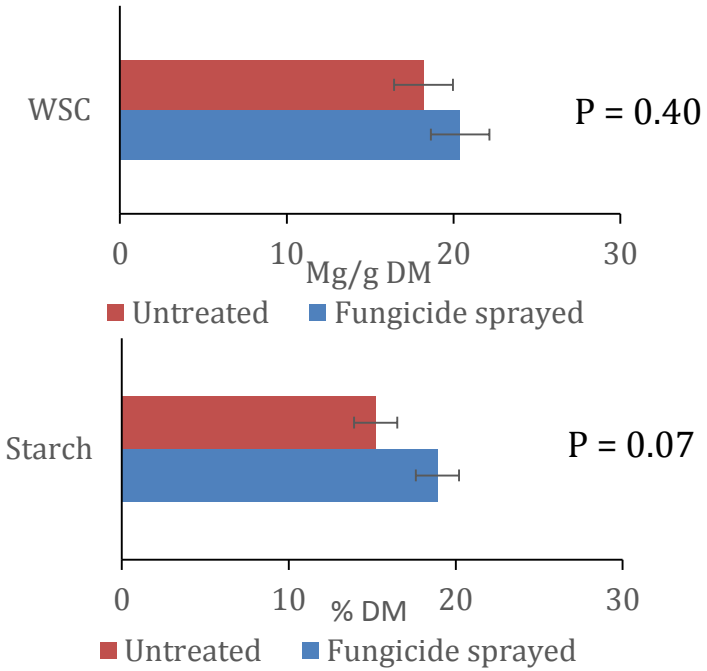


Figure 4: Effect of foliar fungicide application on water soluble carbohydrate (WSC) and starch content of green feed barley (Day 0)

Results and Discussion

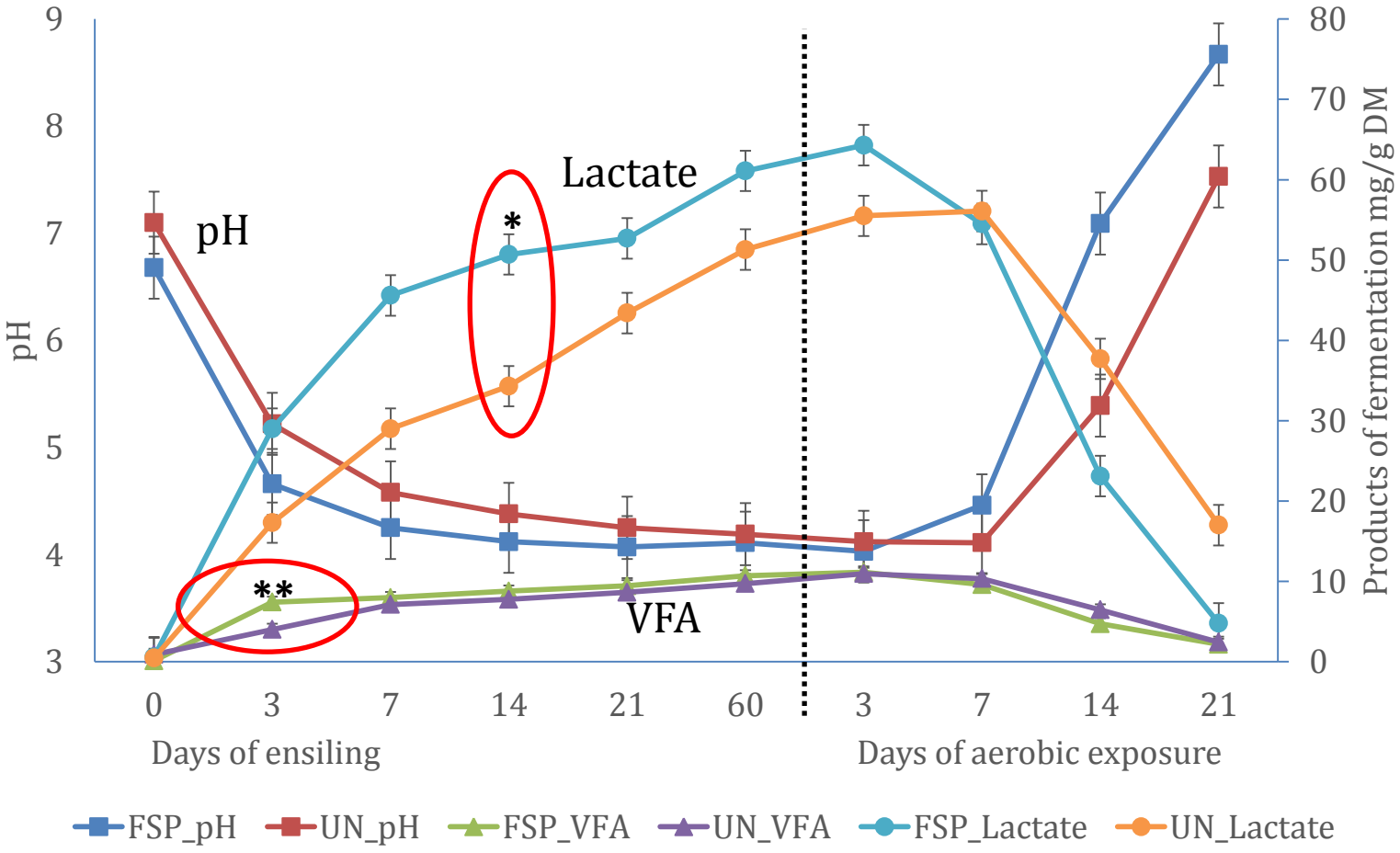


Figure 5: Effect of foliar fungicide application on silage pH, total VFA and lactic acid concentrations

Results and Discussion

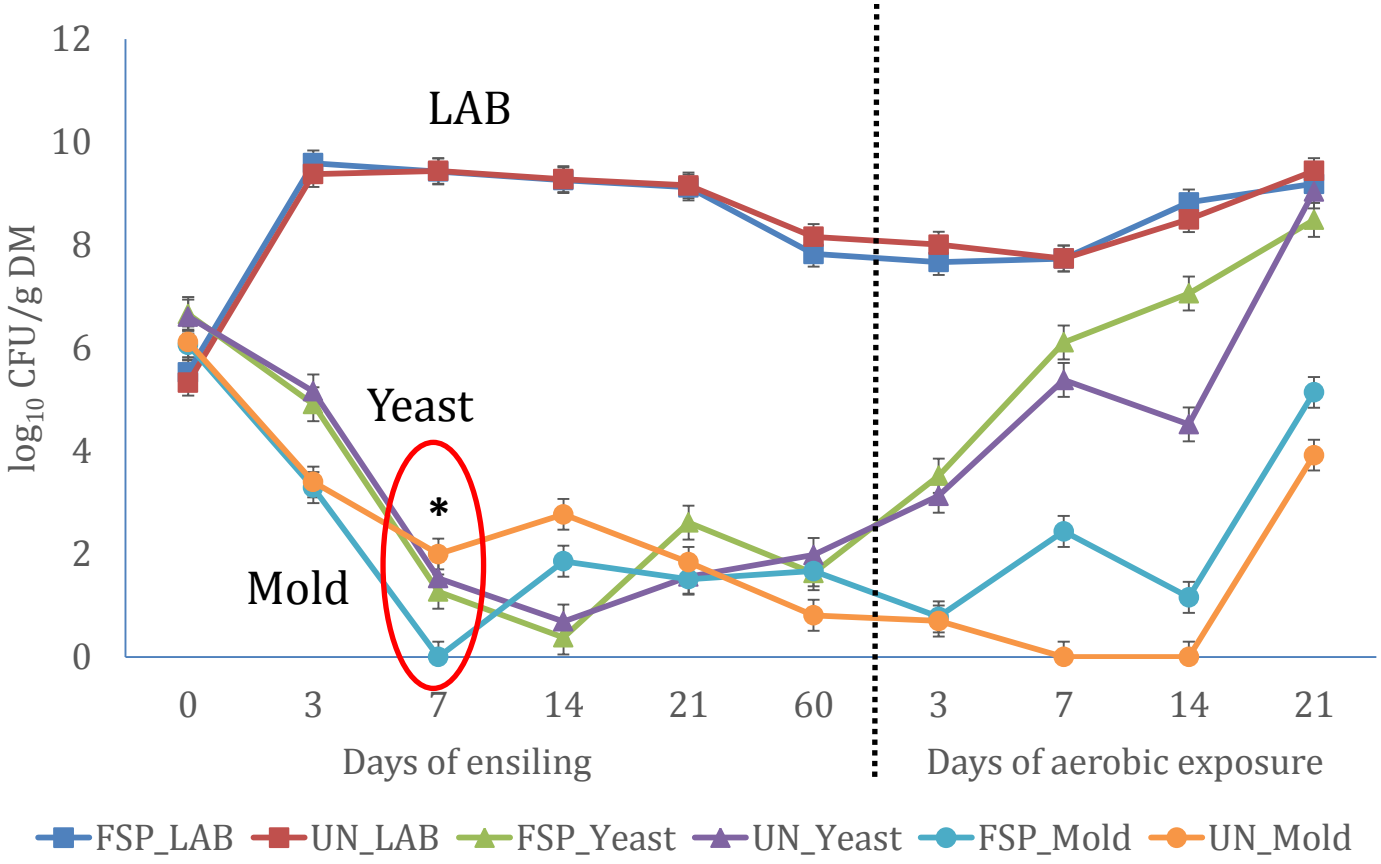


Figure 6: Effect of foliar fungicide application on LAB, yeast and mold counts

Results and Discussion

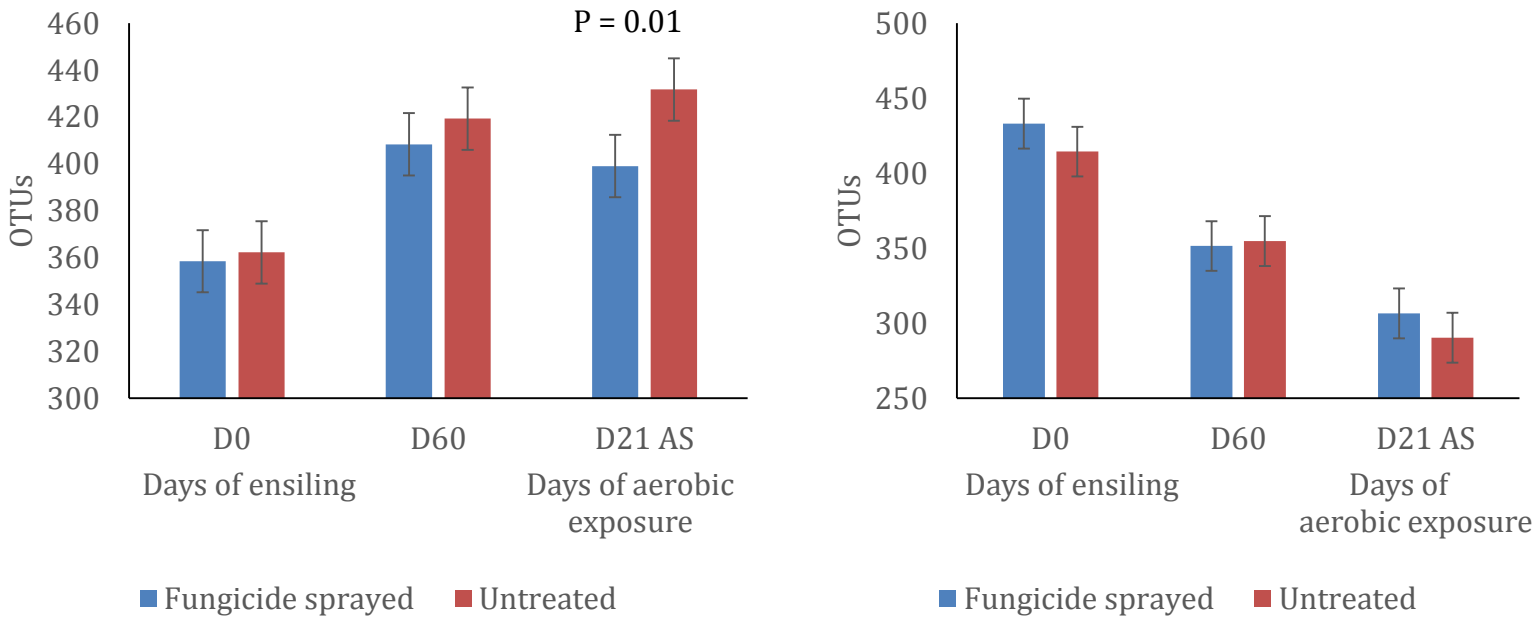
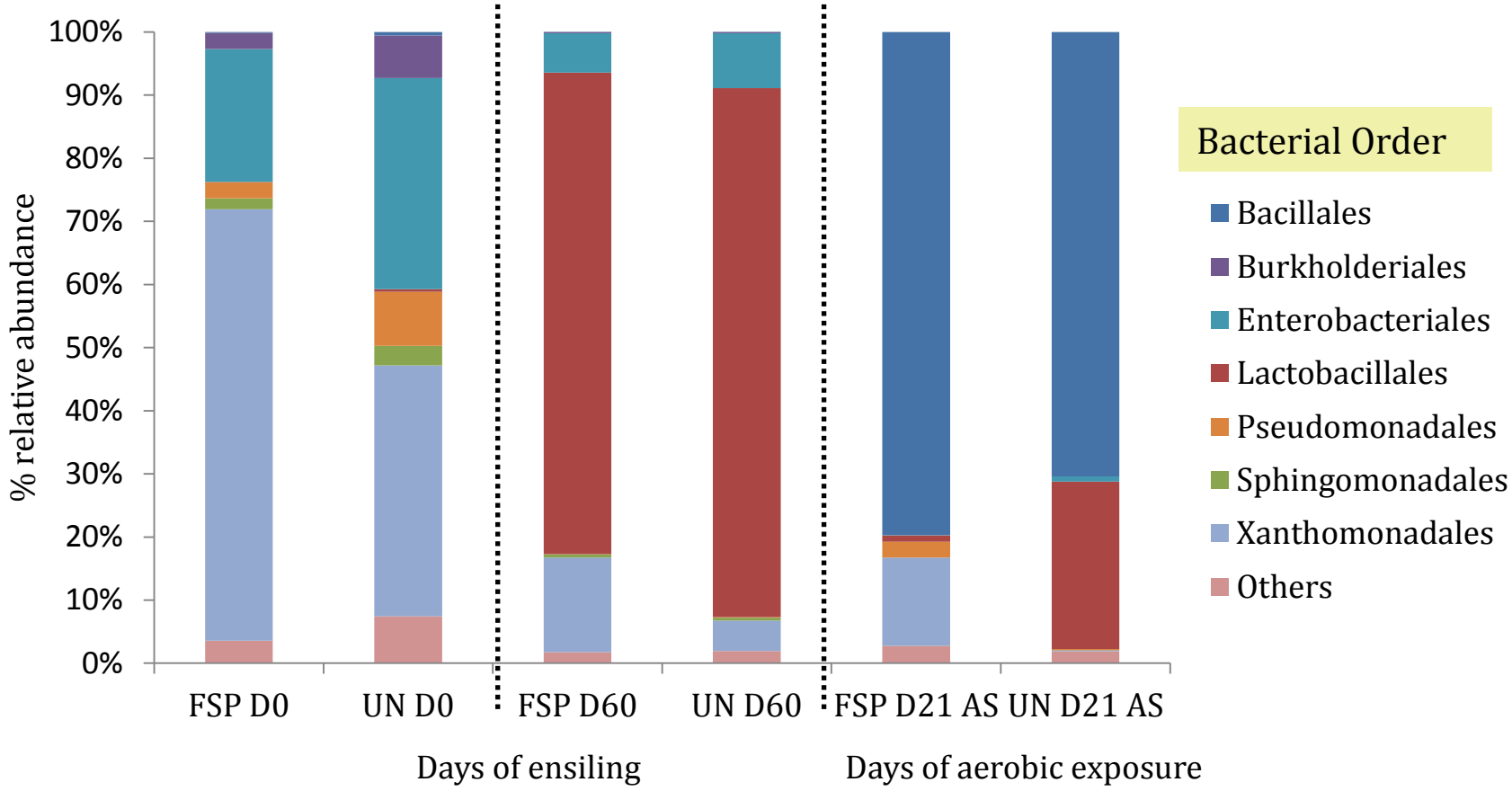


Figure 7: Bacterial and fungal OTUs of barley green feed, silage after 60 d of ensiling and 21 d of aerobic exposure

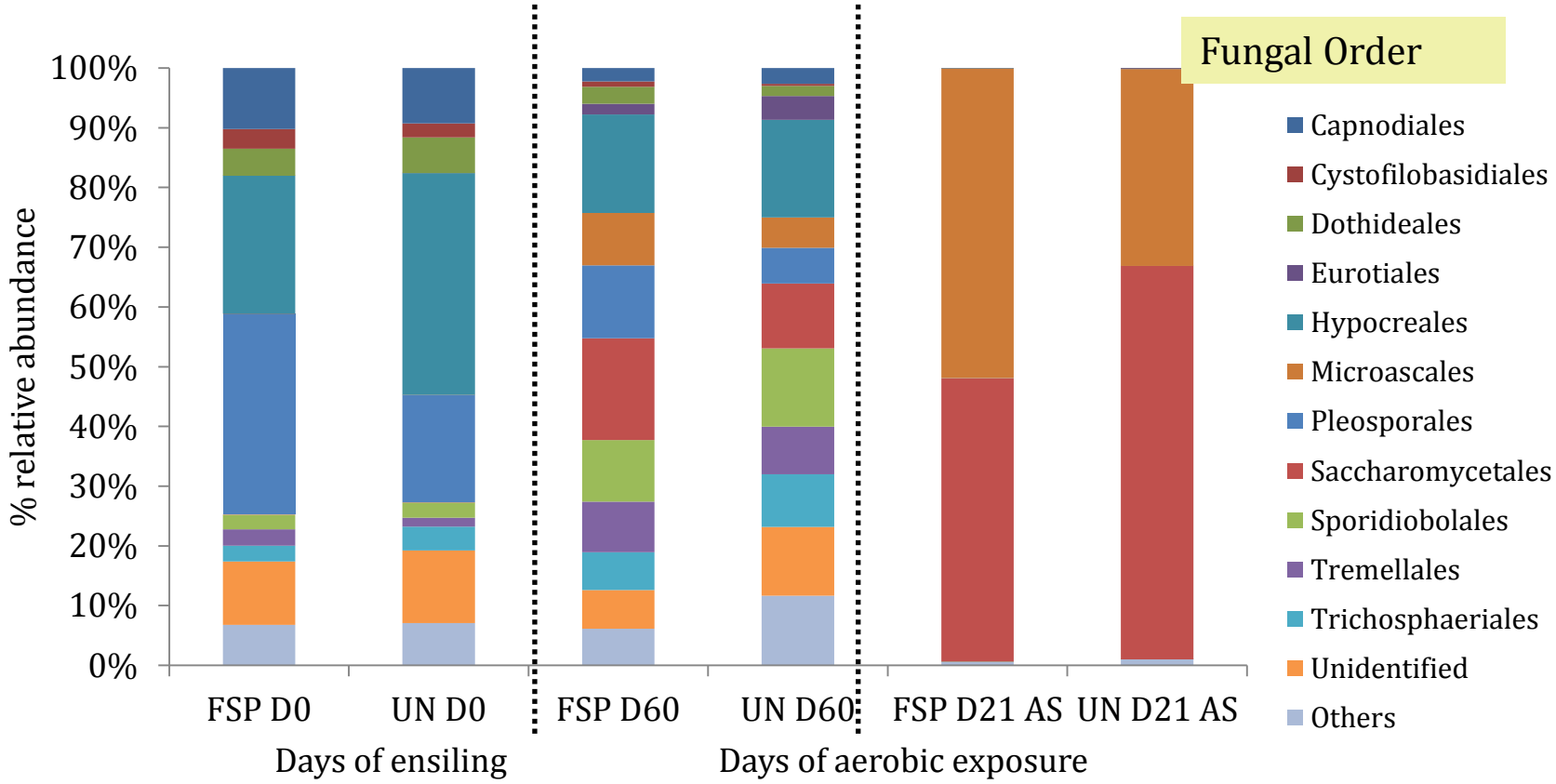
Results and Discussion



FSP, fungicide sprayed; UN, untreated; D0, 60, 21 AS, Day 0 and 60 of ensiling and 21 days after aerobic exposure

Figure 8: Effect of foliar fungicide application on bacterial core microbiome during ensiling and aerobic exposure

Results and Discussion



FSP, fungicide sprayed; UN, untreated; D0, 60, 21 AS, Day 0 and 60 of ensiling and 21 days after aerobic exposure

Figure 9: Effect of foliar fungicide application on fungal core microbiome during ensiling and aerobic exposure

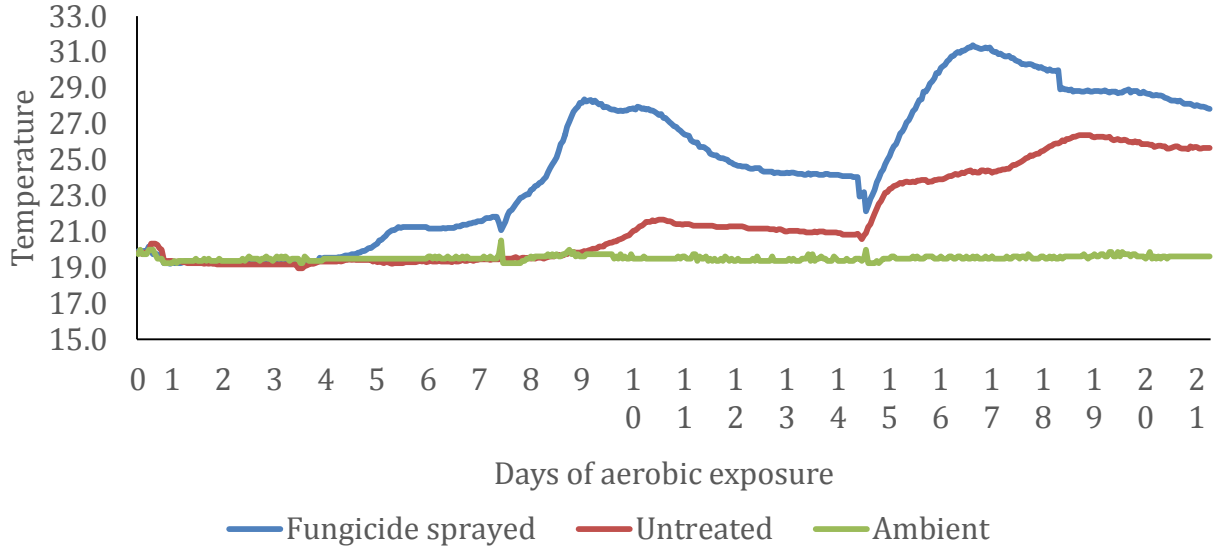
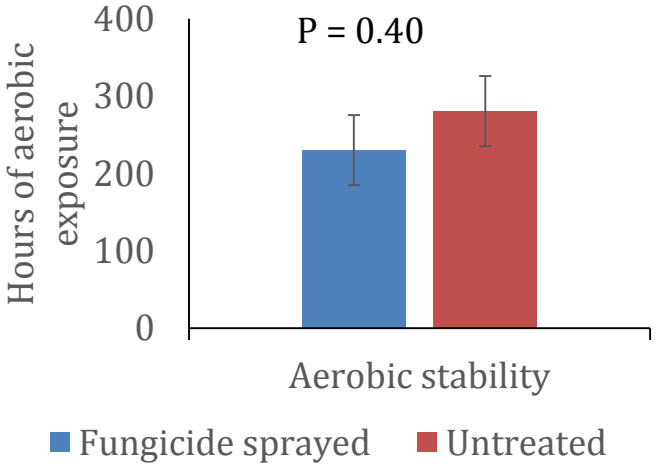


Figure 10: Effect of foliar fungicide application on silage temperature after aerobic exposure



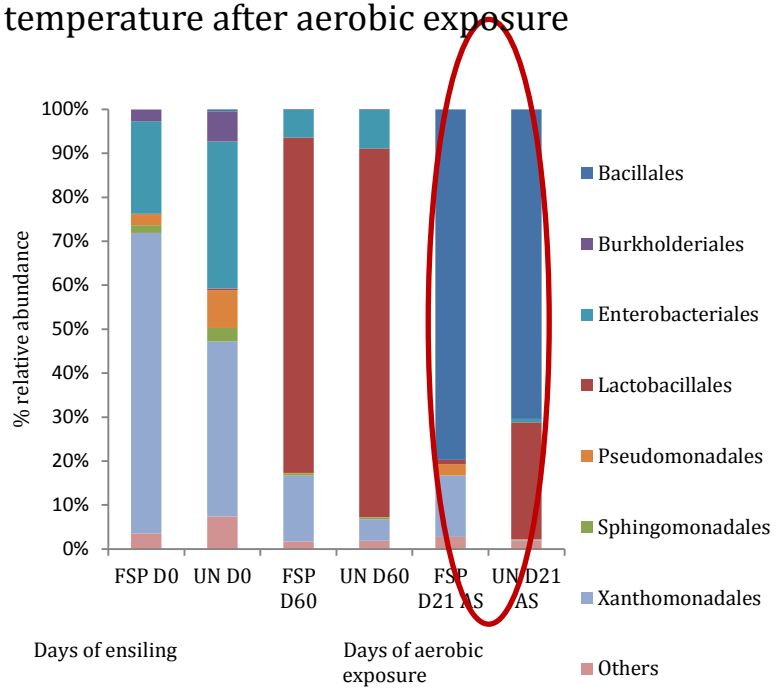


Figure 11: Effect of foliar fungicide application on aerobic stability

Fungicide application

Preserved the forage nutrients (WSC, starch) with likely protection of crop canopy

Lower ADF and NDF content

Fungal OTUs decreased during ensiling and aerobic exposure across treatments and fungicide sprayed barley had lower abundance of order Saccharomycetales after 21 d of aerobic exposure relative to untreated barley

Further research is needed to evaluate the effect of fungicide application of barley silage on performance and carcass characteristics of growing and finishing beef cattle

Acknowledgement

BCRC
BEEF CATTLE RESEARCH COUNCIL

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Agriculture et Agroalimentaire Canada

Canada

Alberta barley