Circular alternatives to peat in casing soil: A microbiome perspective

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4th April 2023

Off The Peat Path

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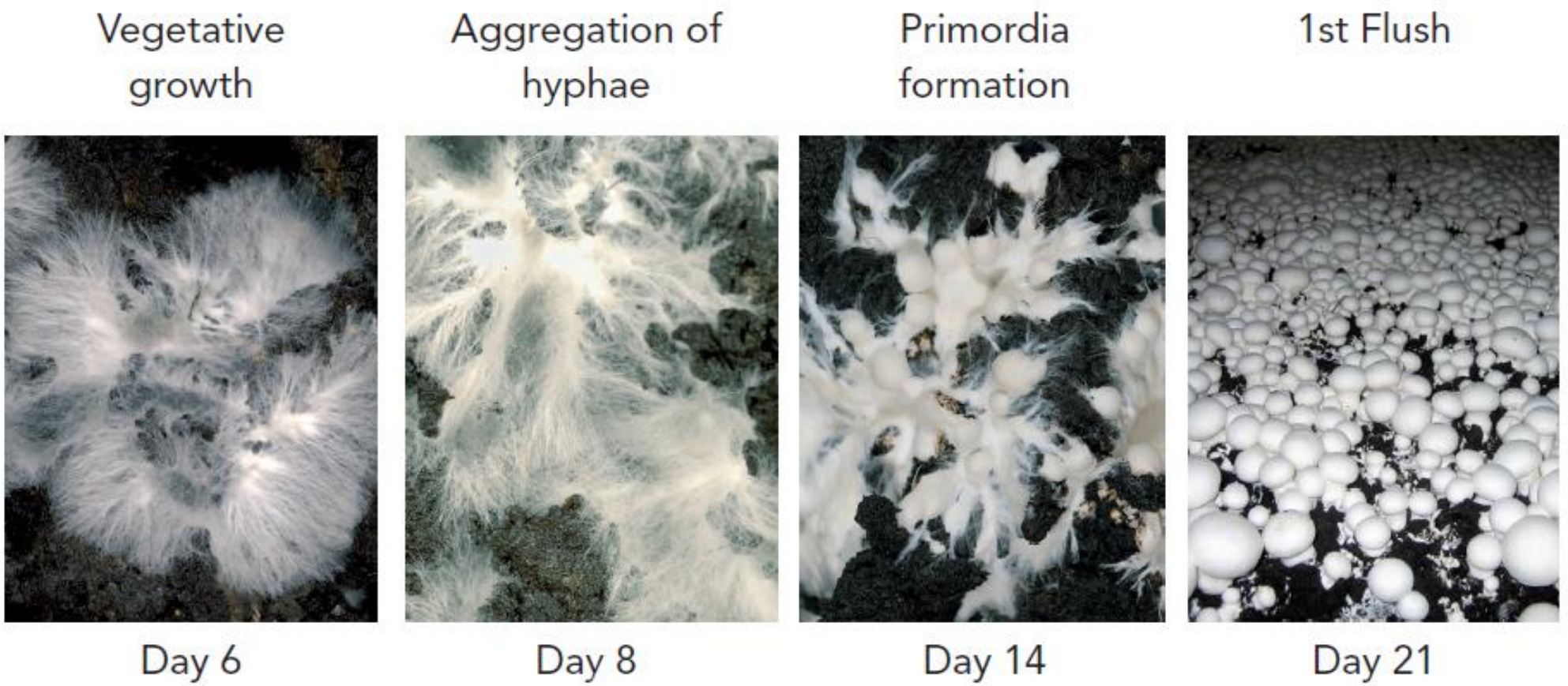
A little bit of background

- Soil microbiologist
- MSc from SLU, SE
- PhD from WUR, NL
- Researcher at UCPH, DK
- Green transition projects
  - Biostimulants
  - Biopesticides
  - Circular substrates

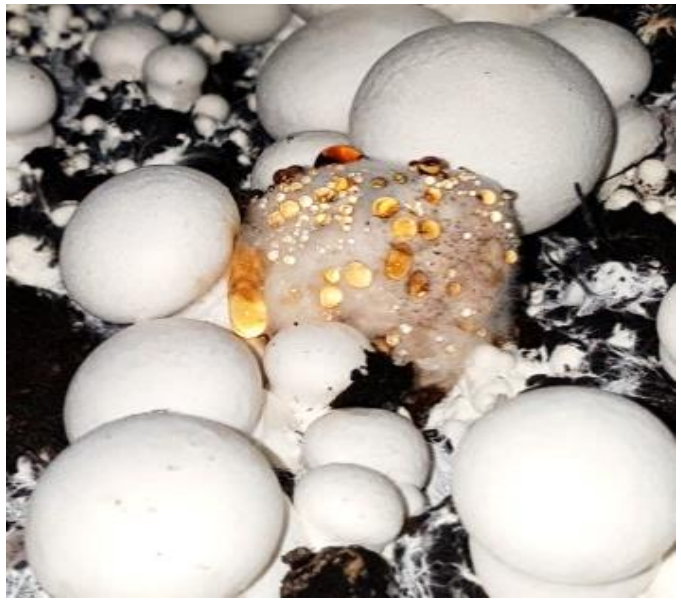
A. bisporus cultivation relies on dynamic interactions with microbes



Berendson et al., 2011

These microbes from the casing soil also cause diseases

M. perniciosa

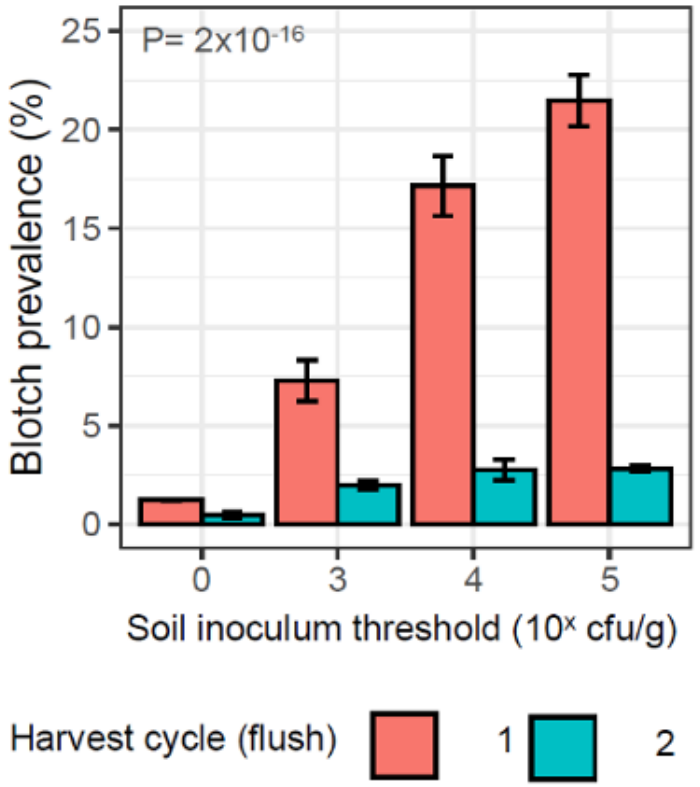


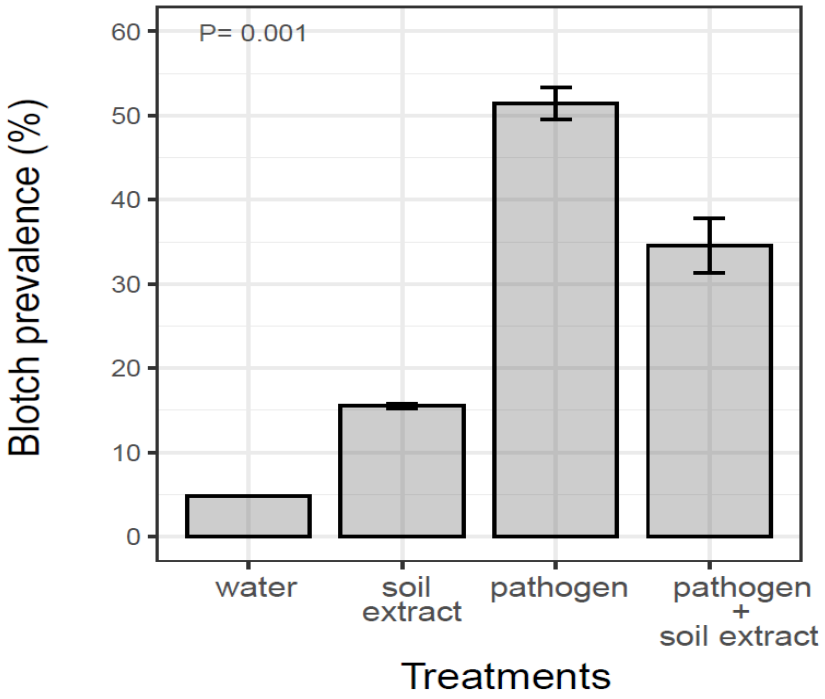
P. tolaasii

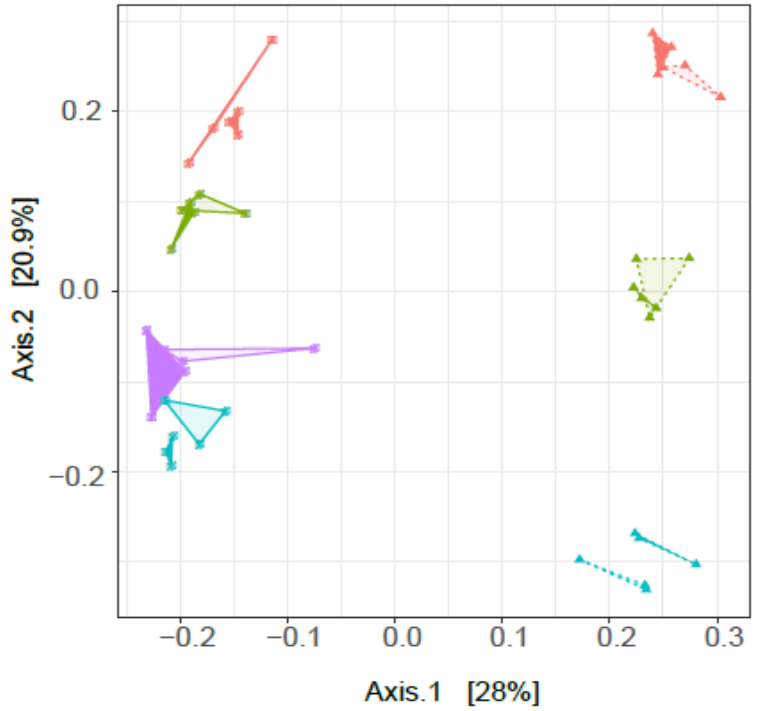
P. gingeri

Taparia et al., 2019

But the casing soil microbiome can also suppress diseases

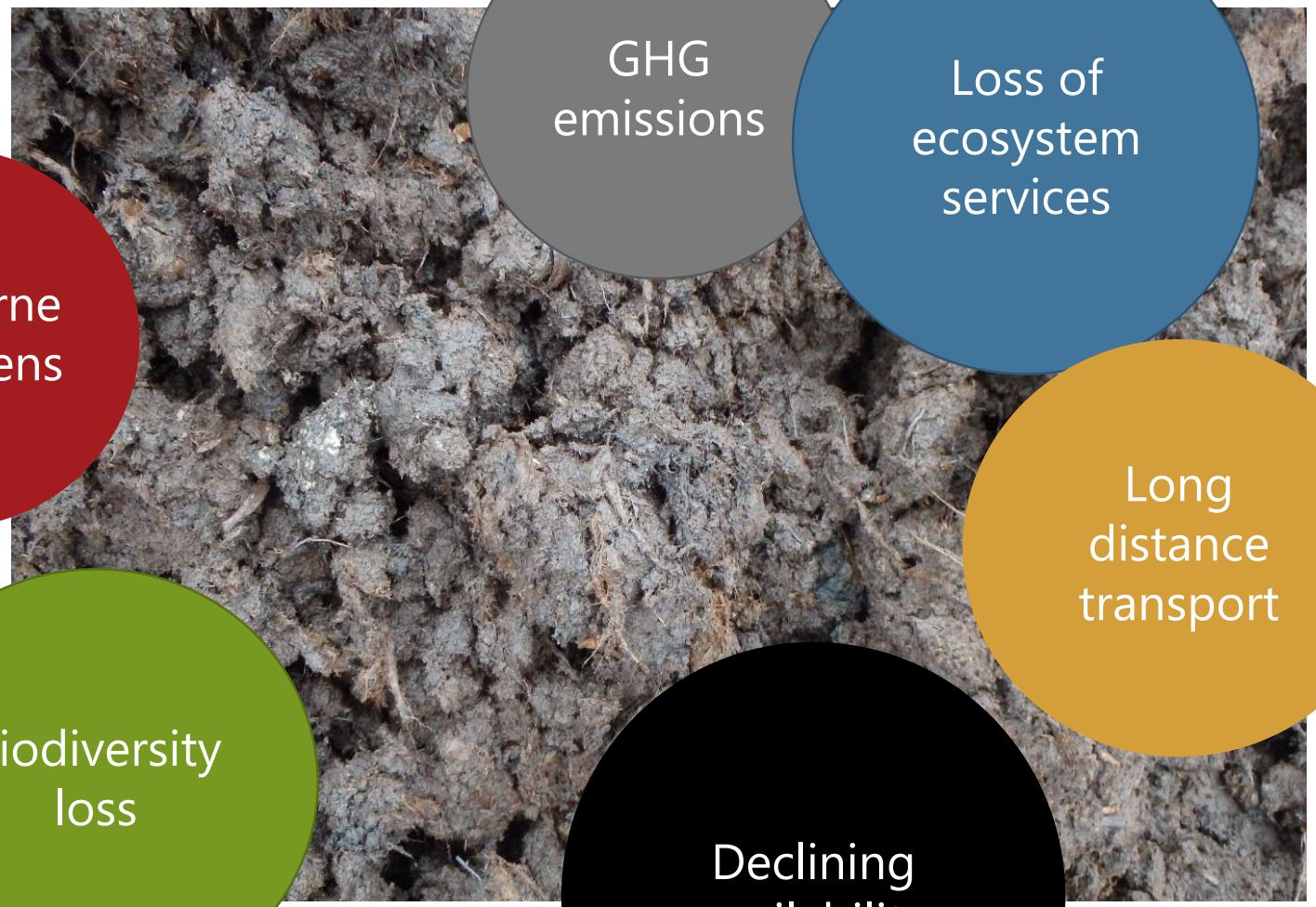






Taparia et al., 2021

Are we off the peat path?



Taparia et al., 2020

Some limitations to peat alternatives

Incomparable performance to peat-based casing soil

Other limitations

- Competitive weed (paper pulp)
- Inappropriate physical characteristics (pine bark)
- Chemical characteristics (spent mushroom substrate)
- Toxic residues (green waste compost)
- Unsustainable sourcing (tea waste)
- Unsupportive legislation (recycled rockwool)
- Lack of economically viability (coir)

Taparia et al., 2021

Peat alternatives

Grass fibres

- Agri-residue streams
- Lignocellulose fibres produced by biorefining
- Circular and local
- Heated vs unheated
- 50% peat replaced

Acidified grass

- Agri-residue streams
- Lignocellulose fibres produced by biorefining
- Acidified via organic feedstock over a year
- Heated vs unheated
- 50% peat replaced

Peat moss

- Moss from Sphagnum sp.
- Harvested every 3-4 years
- Restores degraded and cutover peat-bogs
- Reduces CO_2 emissions
- Heated vs unheated
- 25% peat replaced

Spent casing

- Casing soil separated from compost after cultivation cycle
- Steamed during cook-out
- Reduced costs of SMC
- Higher fertilizer value
- Heated
- 30% peat replaced

Cultivation experiments

Table 1. Experimental design	
Predictor variables	
Alternative	Type of alternative used to replace peat in soil
Steam Treatment	Raw materials steamed at 70°C for 8 h before mixing peat
Pathogen density	Inoculation density of pathogen: *0, 10^3, 10^4, 10^5 cfu/g of soil*
Flush	Progressive harvest cycle: *1st* flush, 2nd flush, 3rd flush
Replicate	Randomized block design within the experiment
Experiment	Independent replicate experiments, with new raw materials
Response variables	
Yield	Total harvest weight per m^2 of growing surface
Blotch prevalence	Proportion of diseased harvest to total harvest (by weight)

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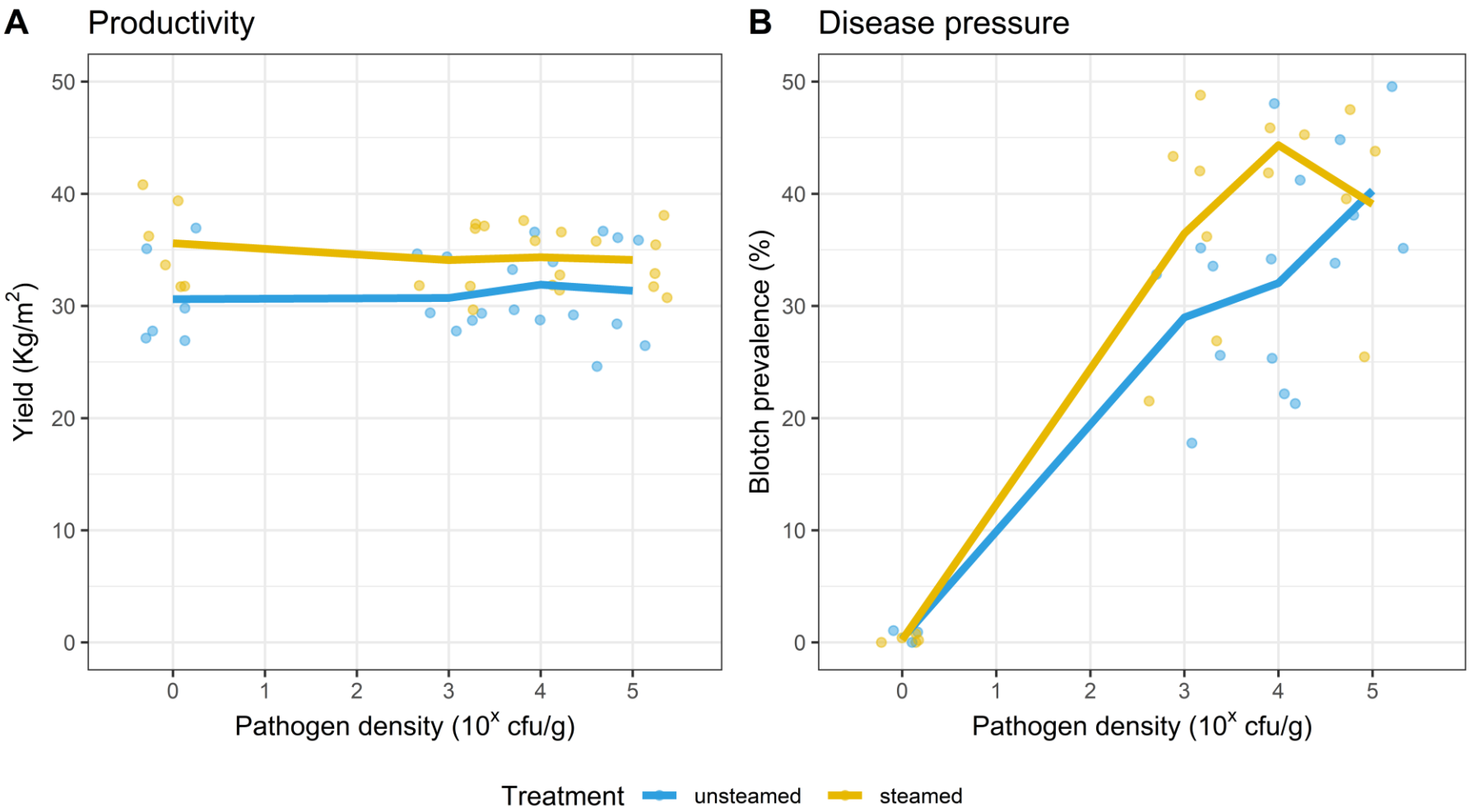
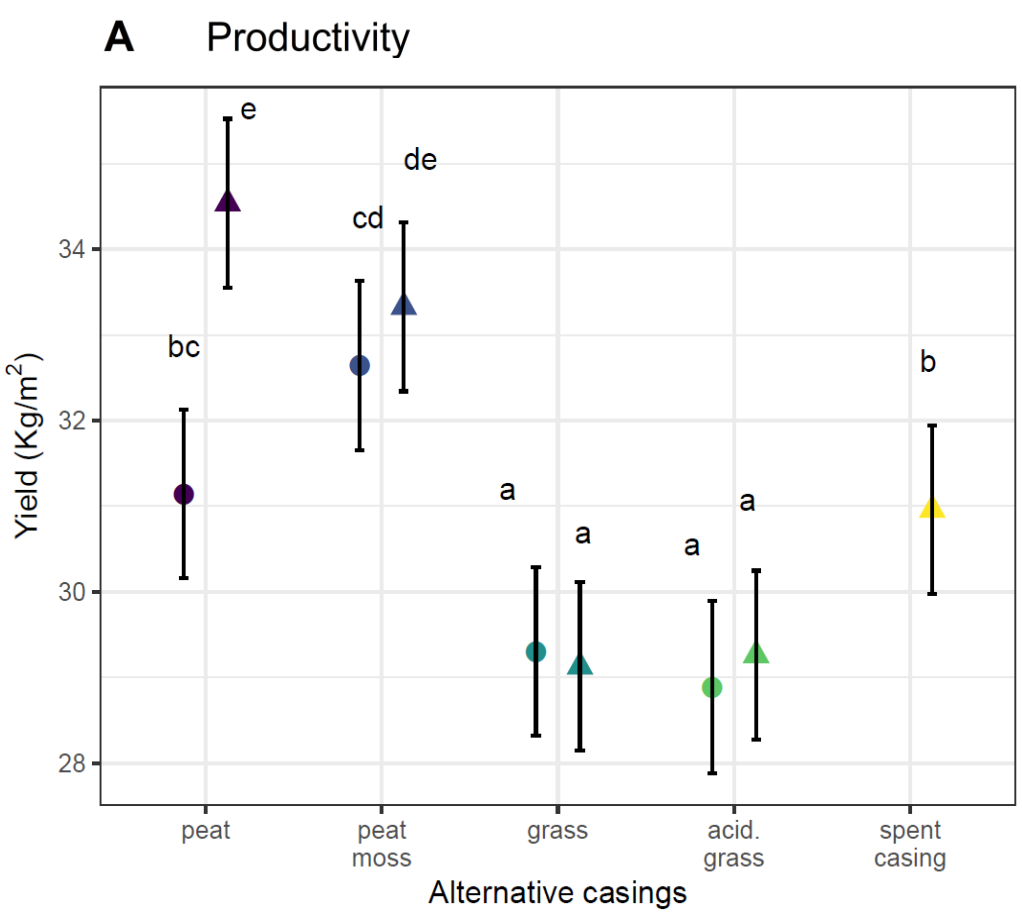
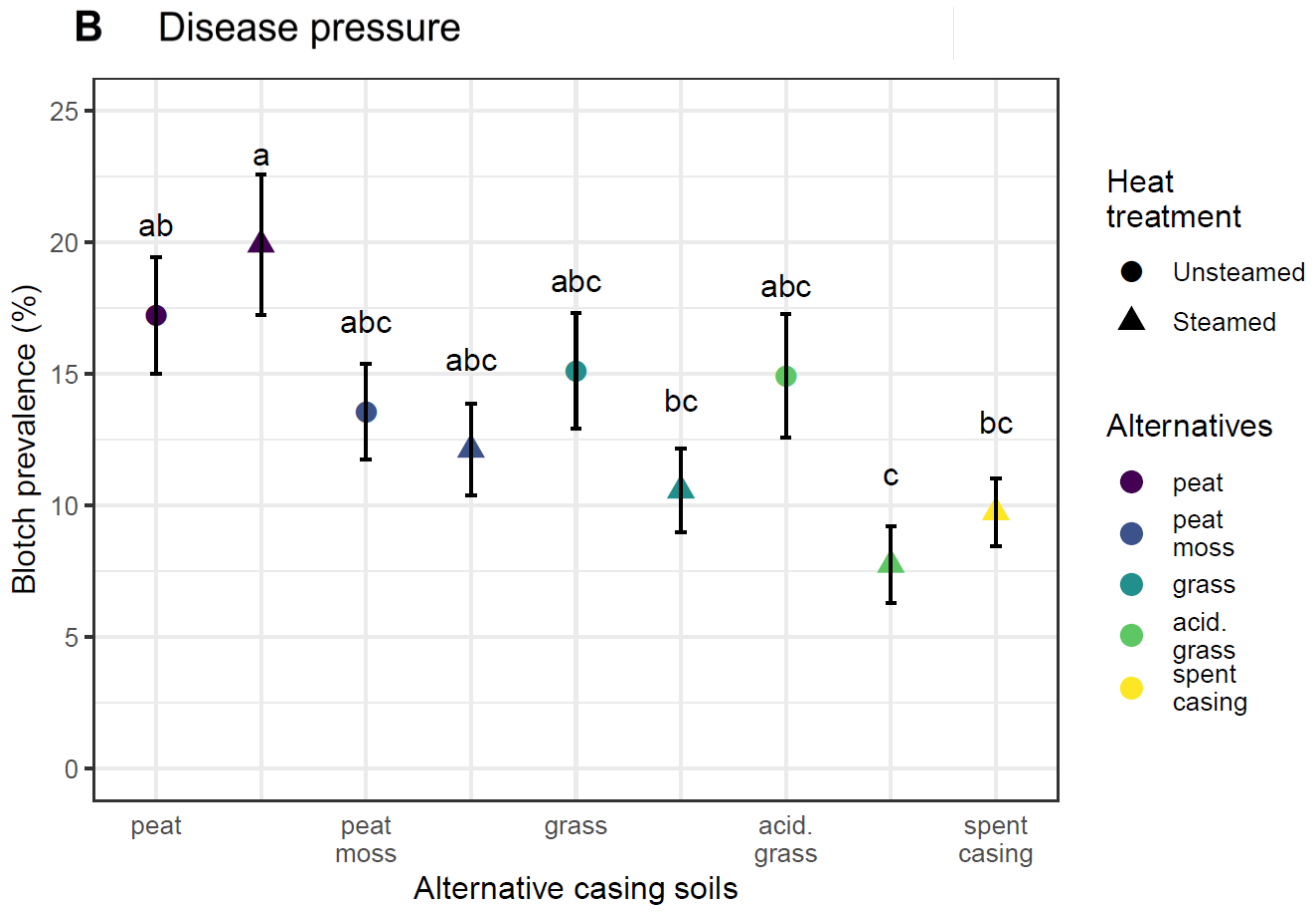
Steam treatment has good and bad effects



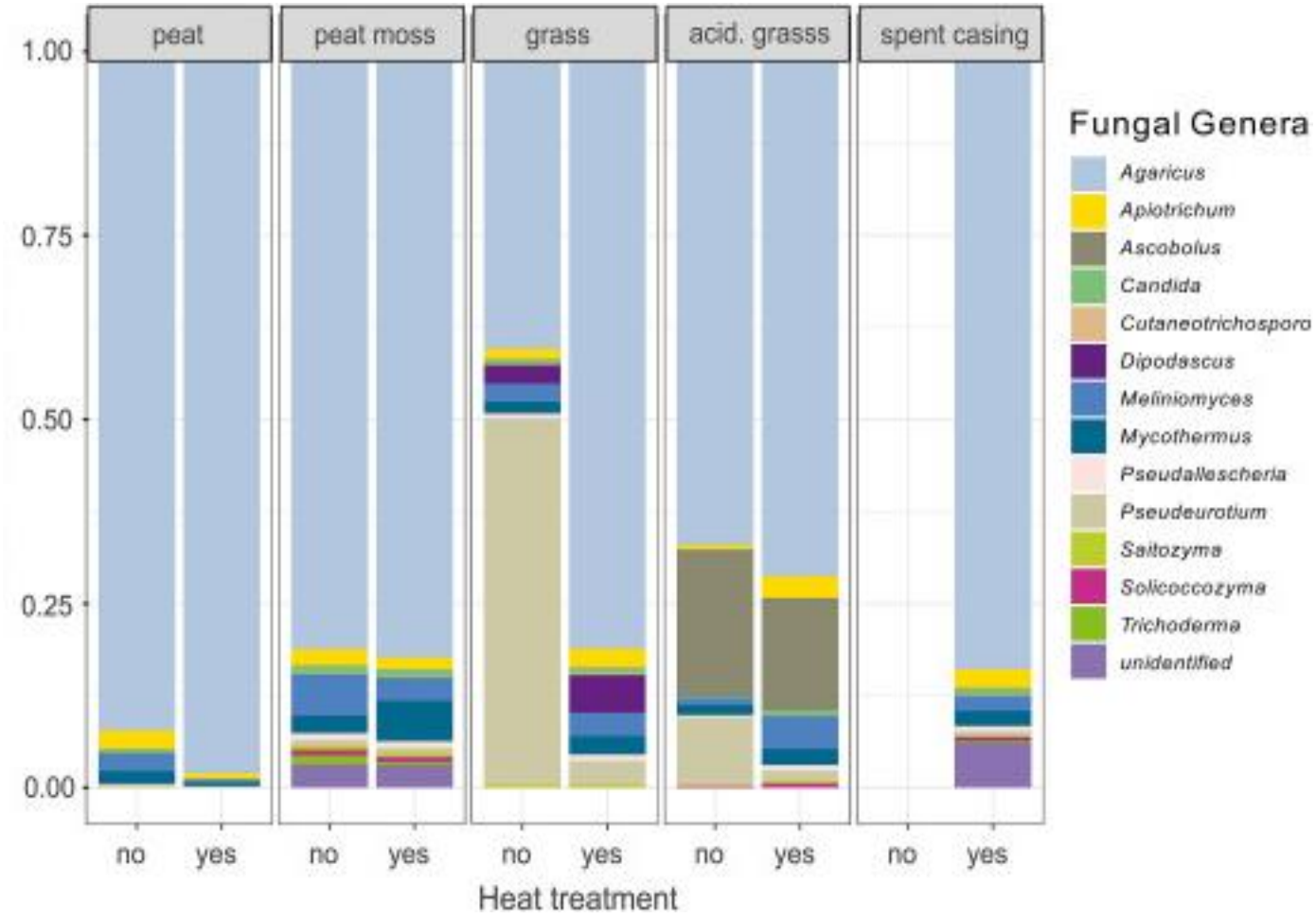
Trade-offs between yield and disease pressure





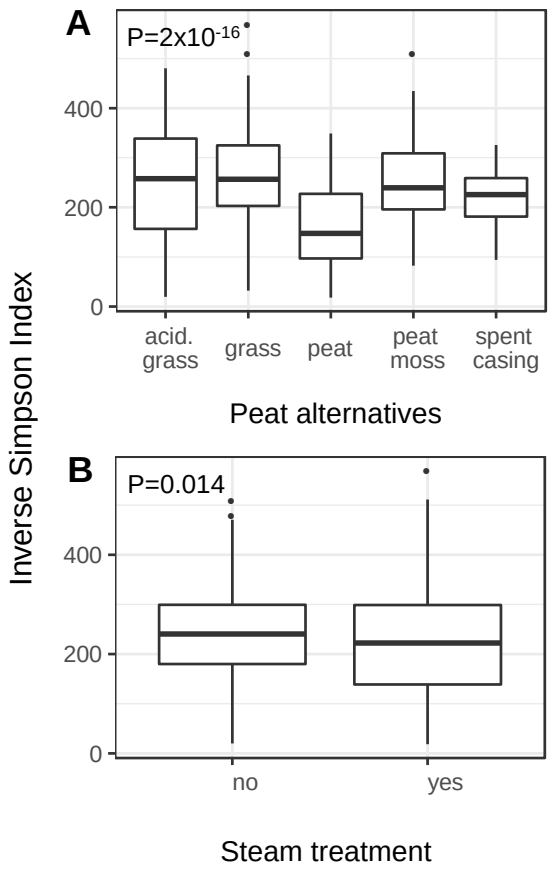
Taparia et al., 2021

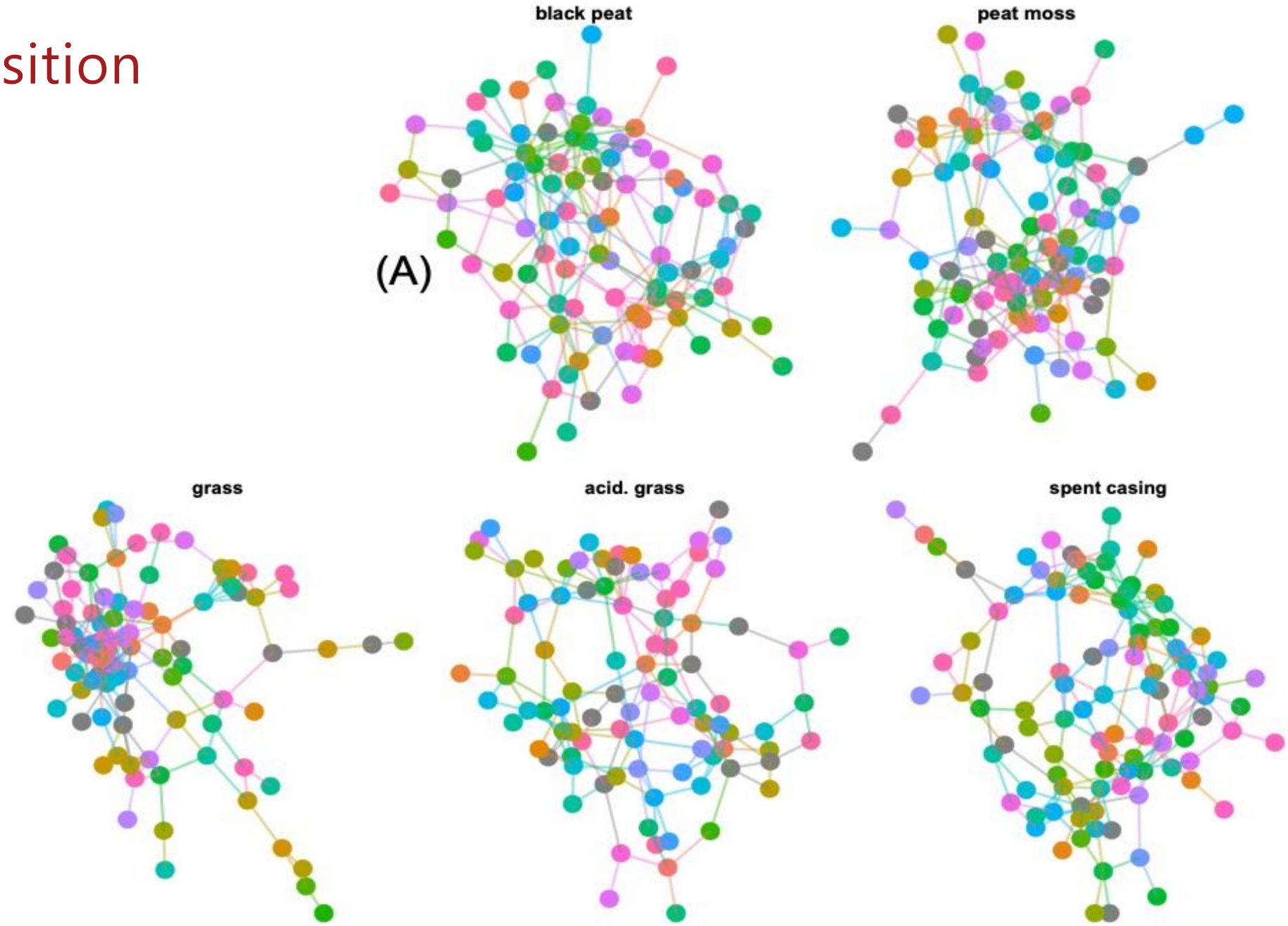
Fungal composition



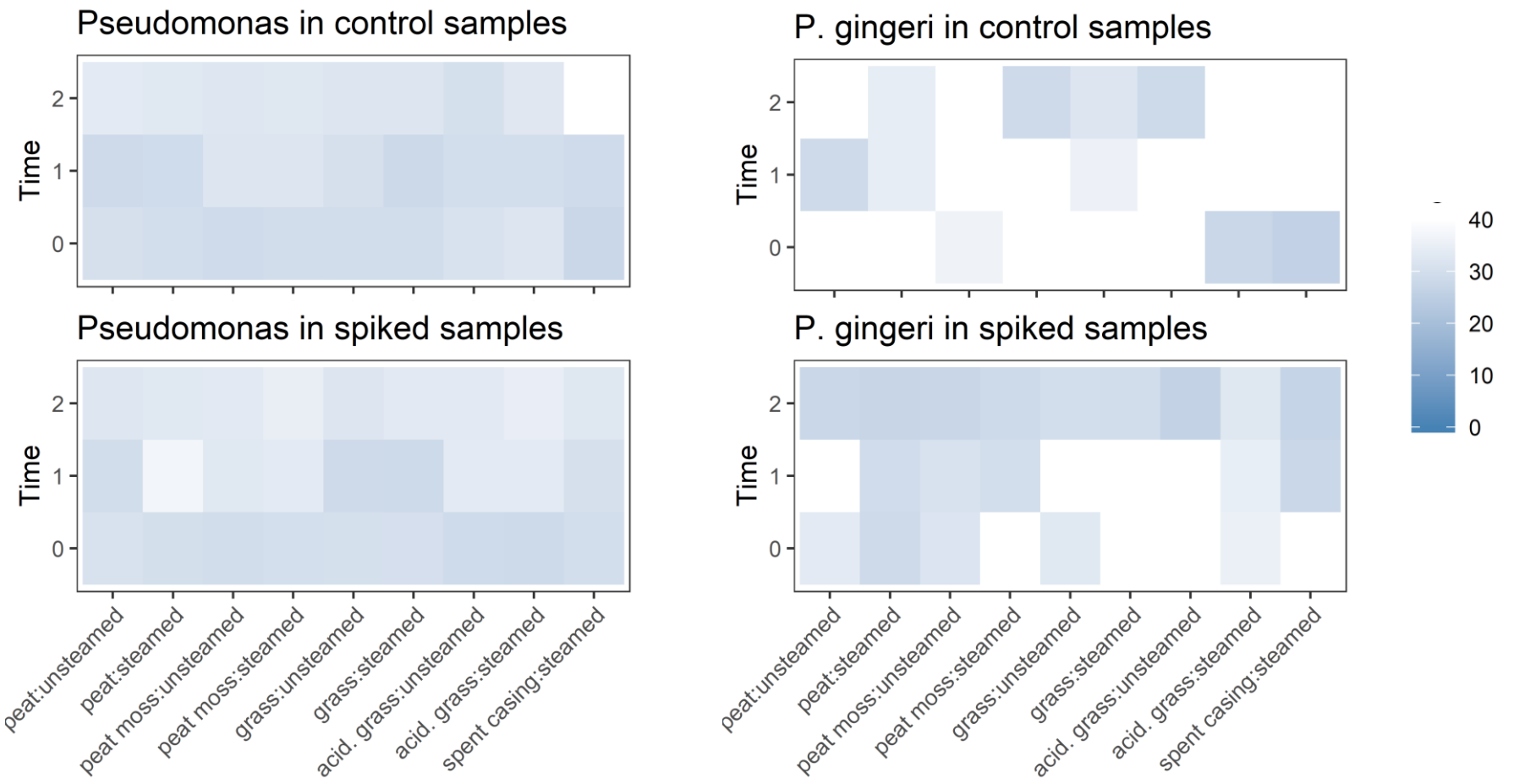
Taparia et al., 2021

Bacterial composition

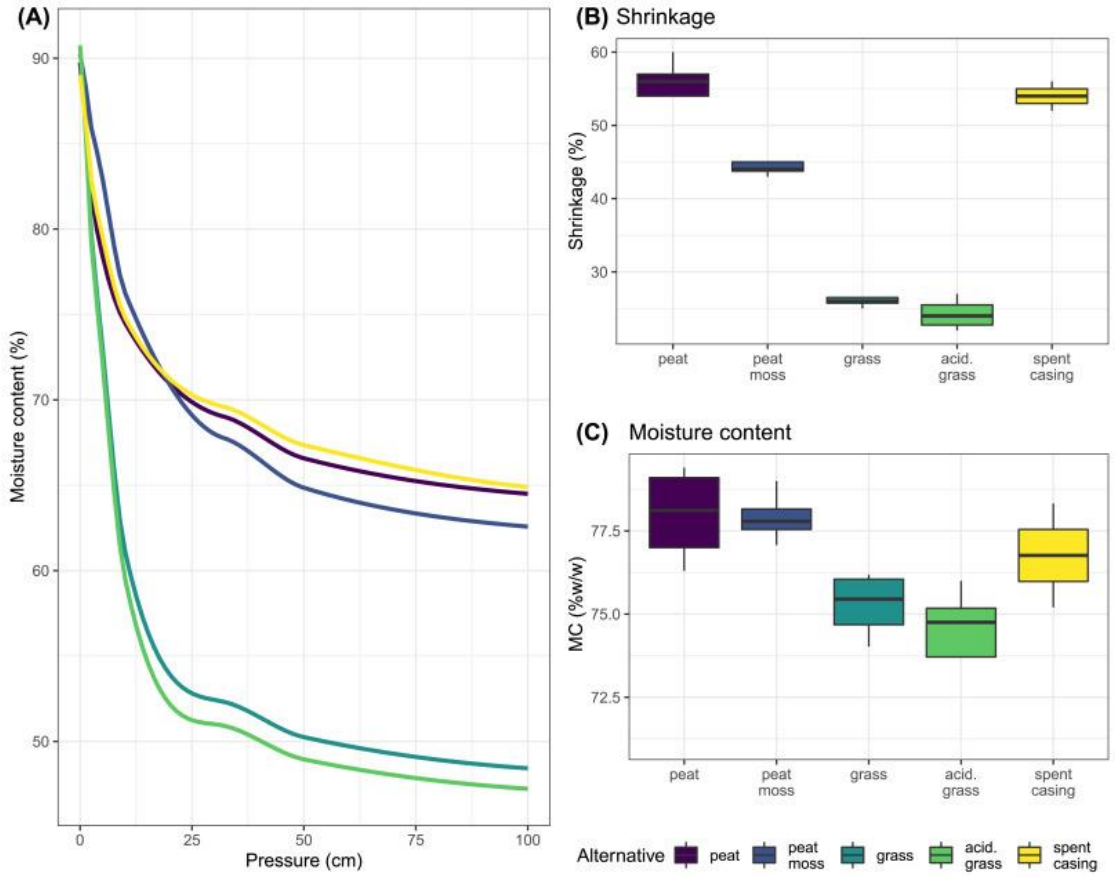


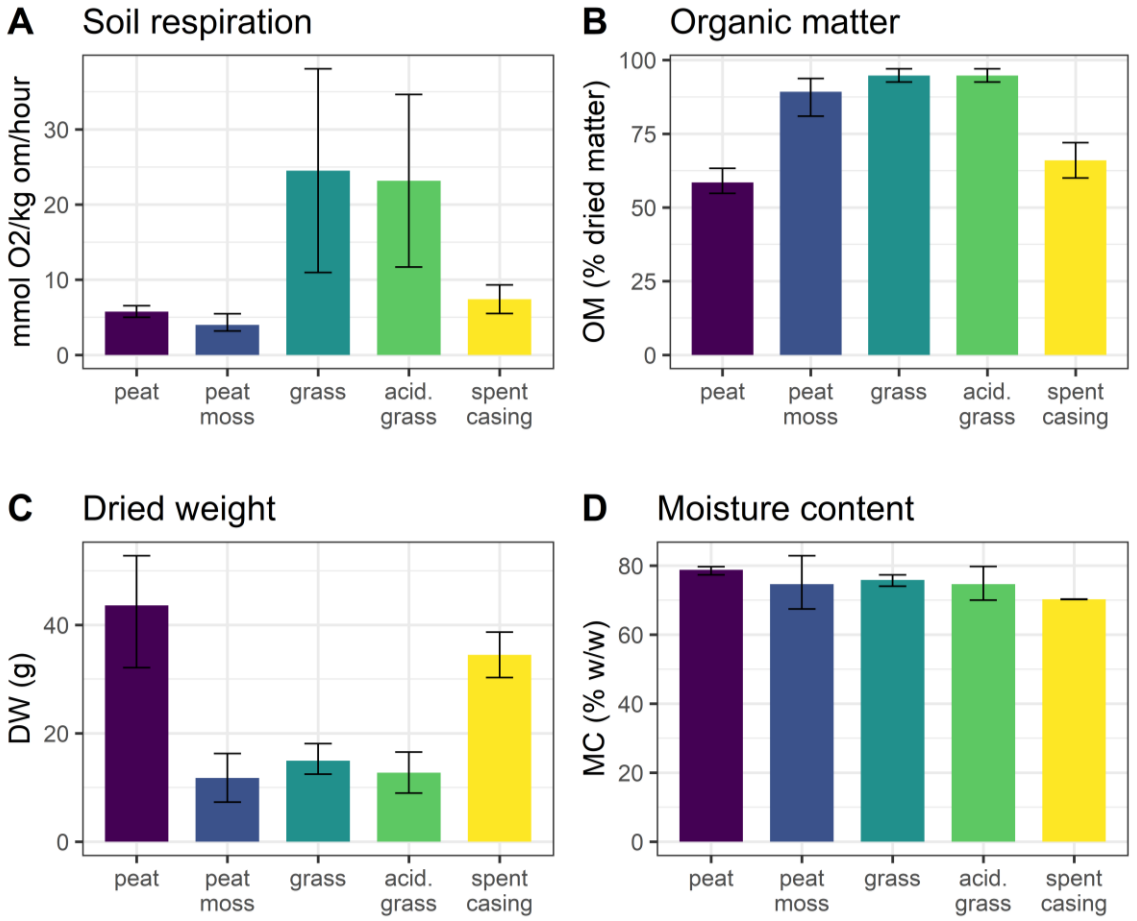


Diagnostic qPCRs



Raw materials





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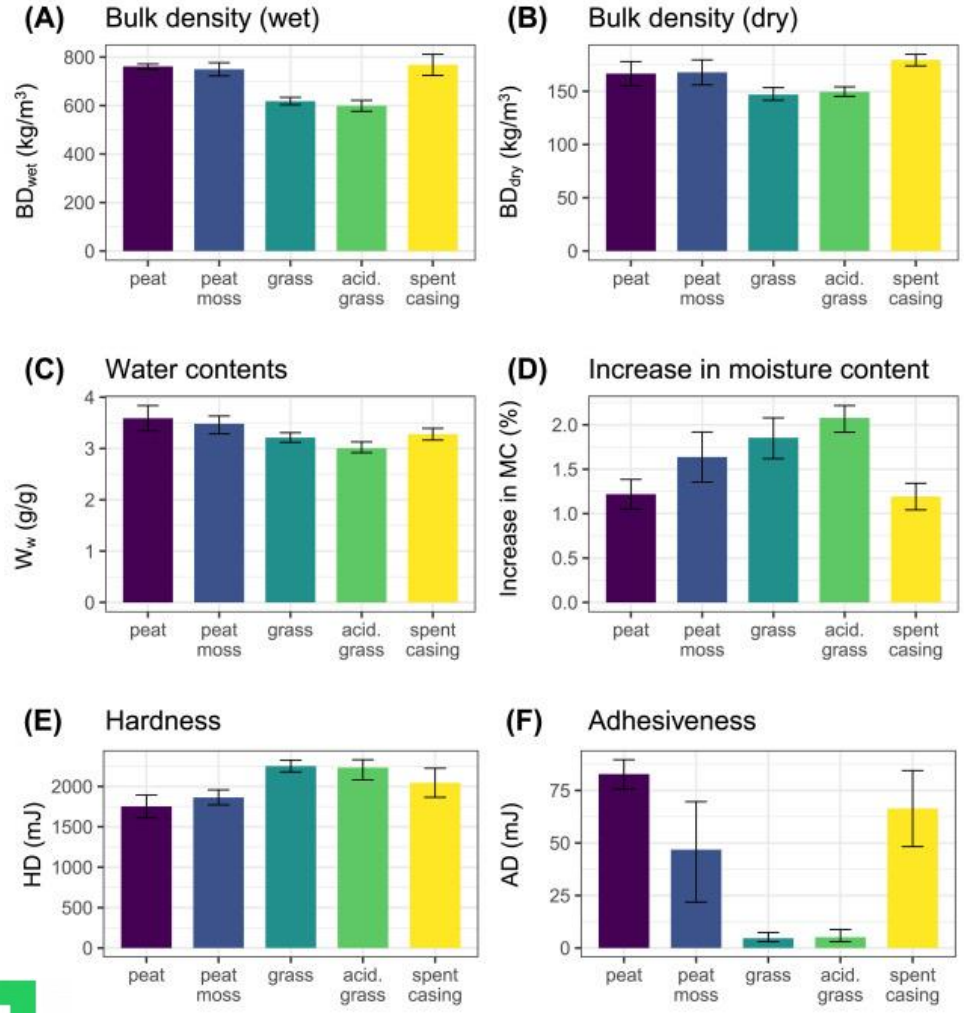
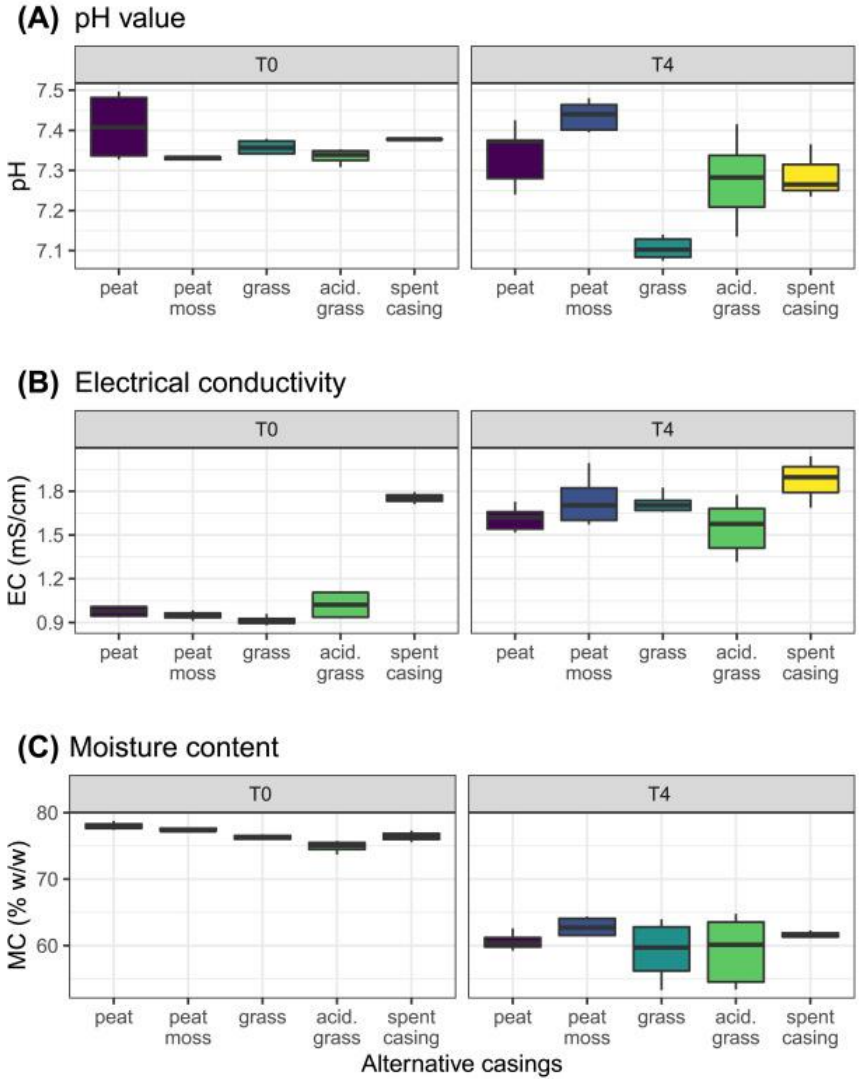
Other properties

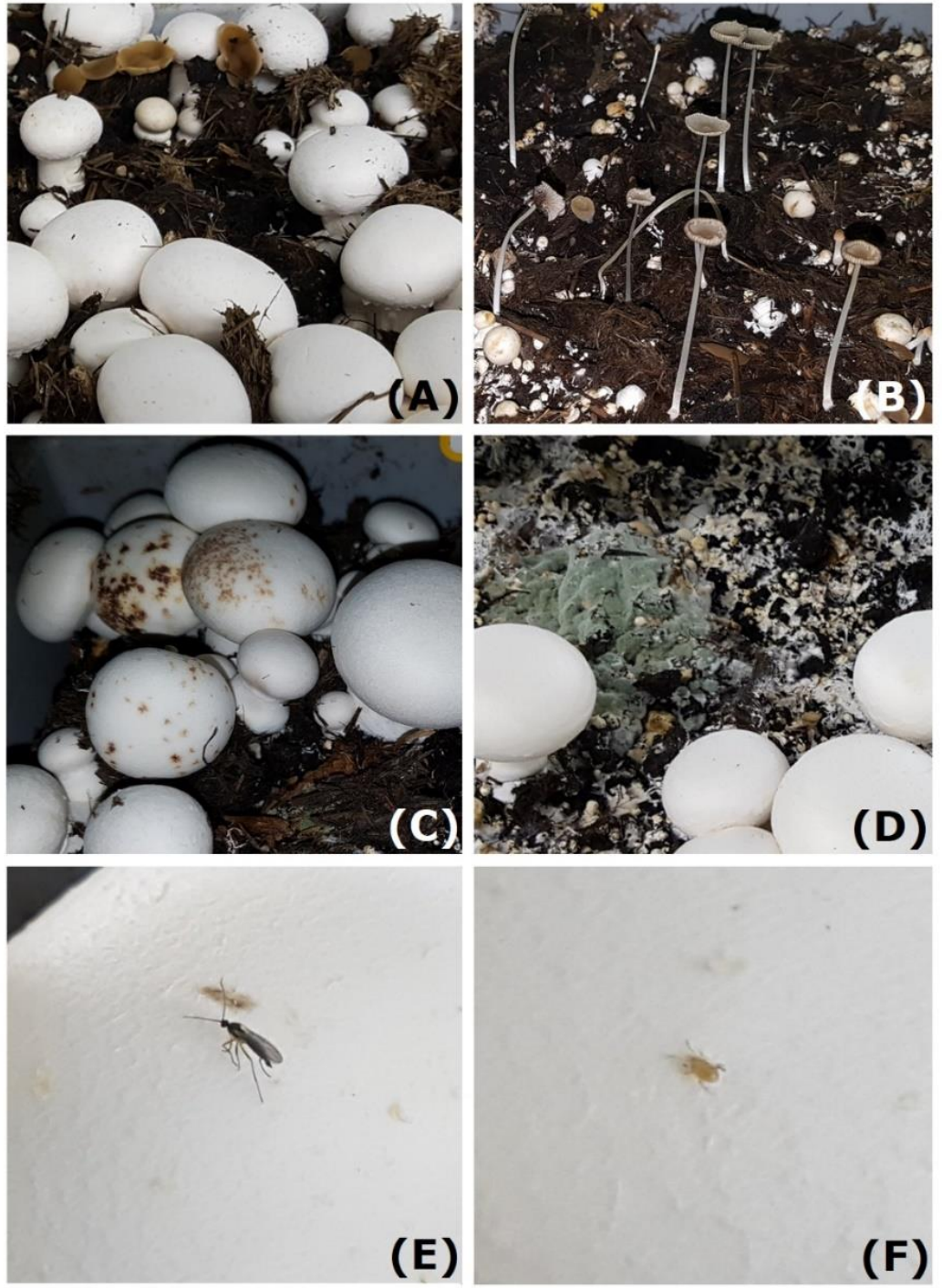




Taparia et al., 2021

Risk of pests and pathogens

- Competitive fungi (*Peziza* and *Parasola* sp.)
- Brown blotch (*Pseudomonas* sp.)
- Green mould (*Trichoderma* sp.)
- Mites
- Gall midges (*Mycophila speyeri*)
- Scarid flies (*Lycoriella auripila*)



Taparia et al., 2021

Moving towards circularity

Peat use in the Dutch mushroom industry, can be reduced by 30%

- at no loss of productivity
- accompanied by a reduced disease pressure
- peat moss seems is a potential product

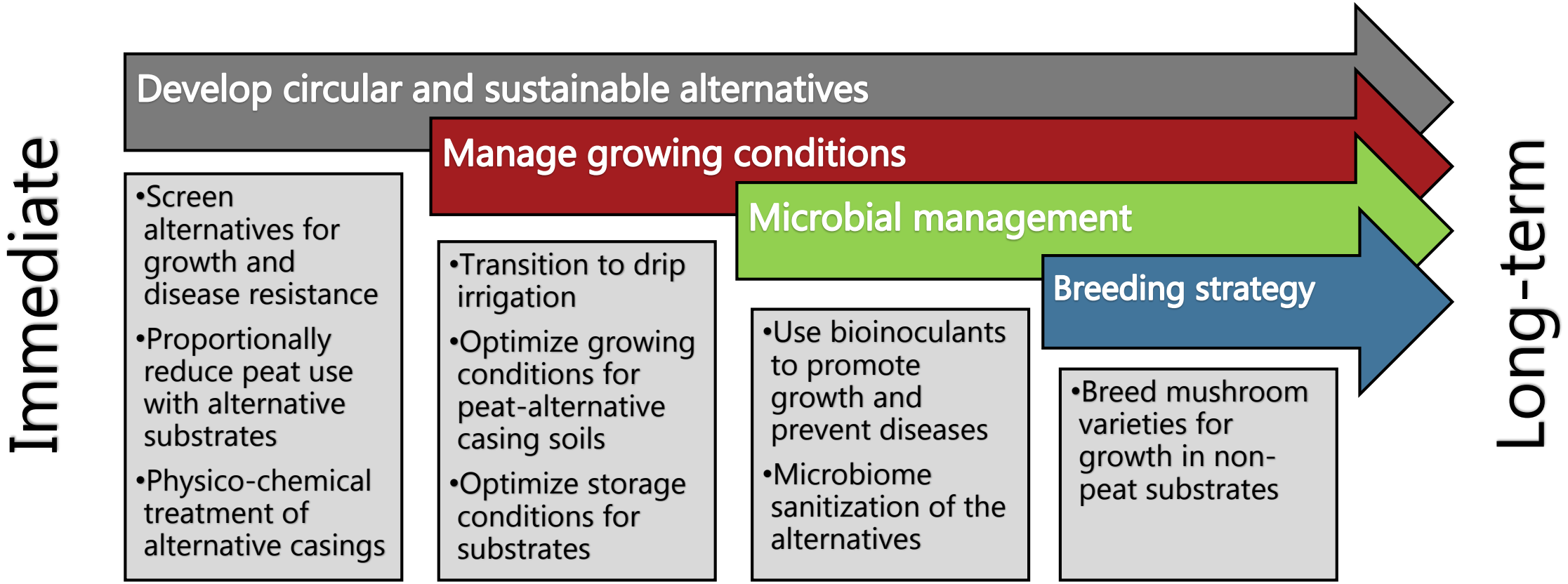
When peat use is reduced by 50%

- the yield reduces
- but so does the disease pressure

Spent casing soil can be recycled upto 30%

- steaming can come at no additional cost
- more suppressive to blotch diseases

General strategy



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Thank you

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