



Transforming UK Food Systems Conference, 23-24 March 2026



#TUKFS26





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Symposium 1.4

Environmental and socioeconomic impacts of transitioning to Regenerative Agriculture

Pippa Chapman (Chair)

Lynn Dicks (Discussant)





Soils, where
food begins



BRITISH
ECOLOGICAL
SOCIETY

Regenerative Agriculture in the UK

An ecological perspective

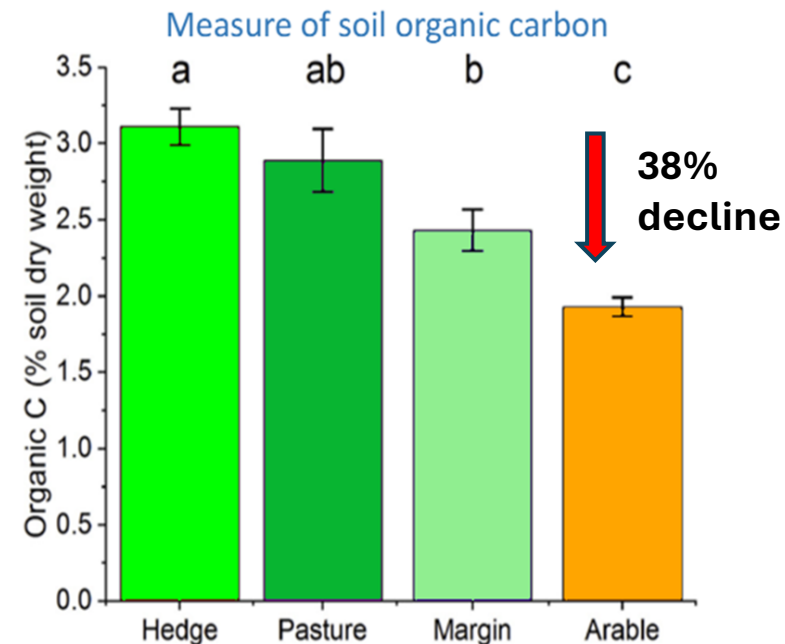
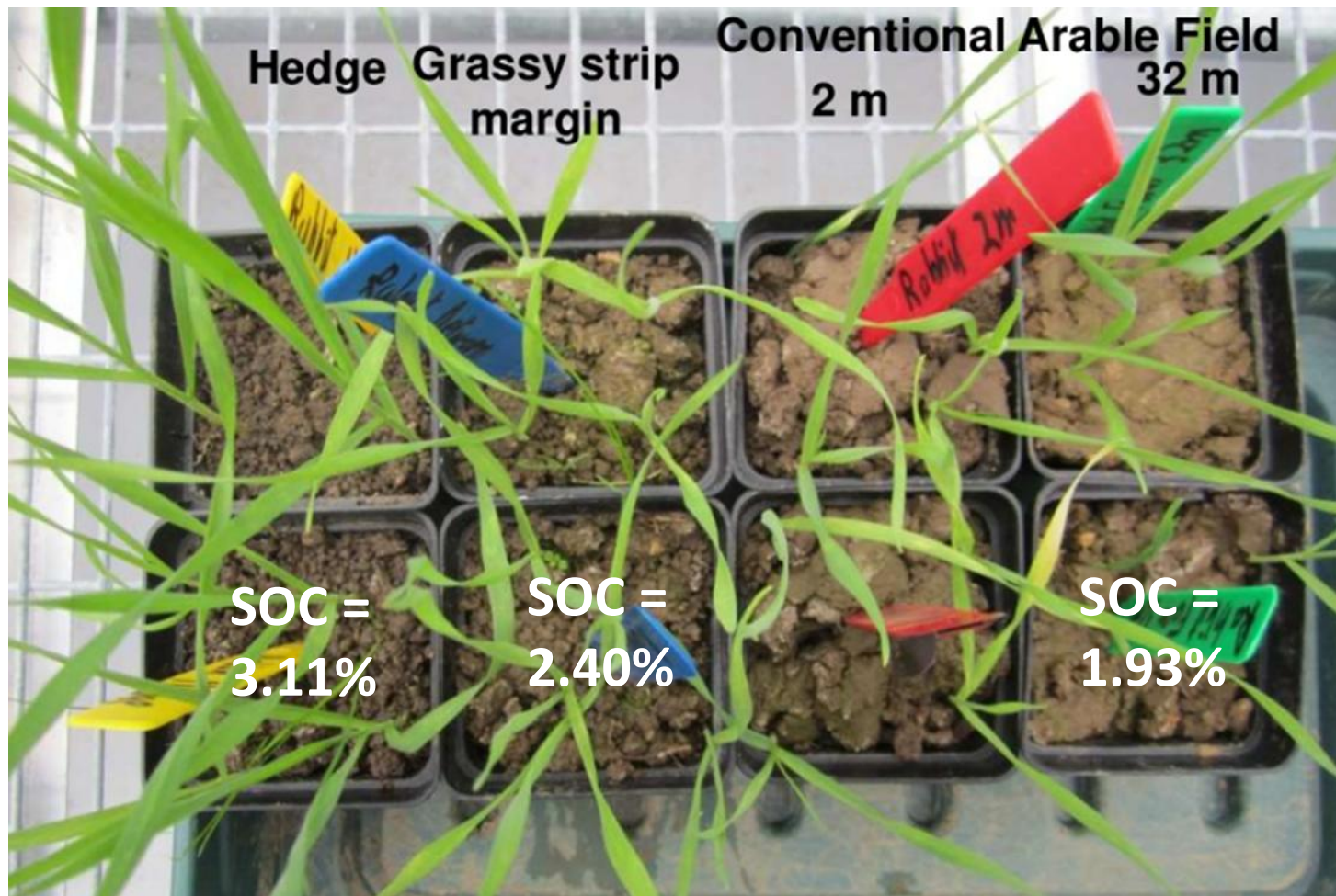


Through science we can

Food Production: The Challenge

- Our food production relies on healthy soils, nutrient cycling, pollination and water regulation
- Agriculture has led to environmental degradation and there is a **hidden cost to food production**
- **E.g., soil degradation** in the EU has an economic cost of > € 50 billion per year
- Agricultural production will have to increase to meet the **global food demand**
- Urgent need for agriculture **to become more sustainable, adapt to climate change and build resilience**

What has been the impact of agriculture on soil health?



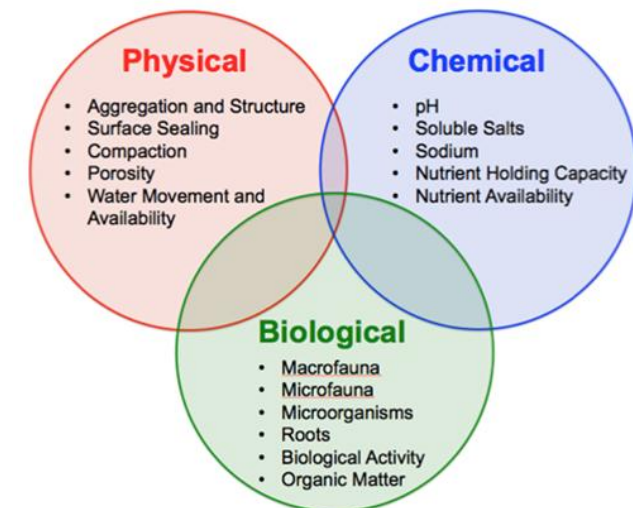
Decline in soil organic matter and soil structure associated with intensive cultivation and annual cropping.

Photo: Ewan Marshall-Harries and Jonathan Leake, University of Sheffield.

Can changes in agricultural practices improve soil health and lead to a more sustainable and resilient farming system?



Is regenerative agriculture the answer?



Measuring effects of stacking regenerative agriculture principles: The challenges of intercropping beans and oats during a drought year

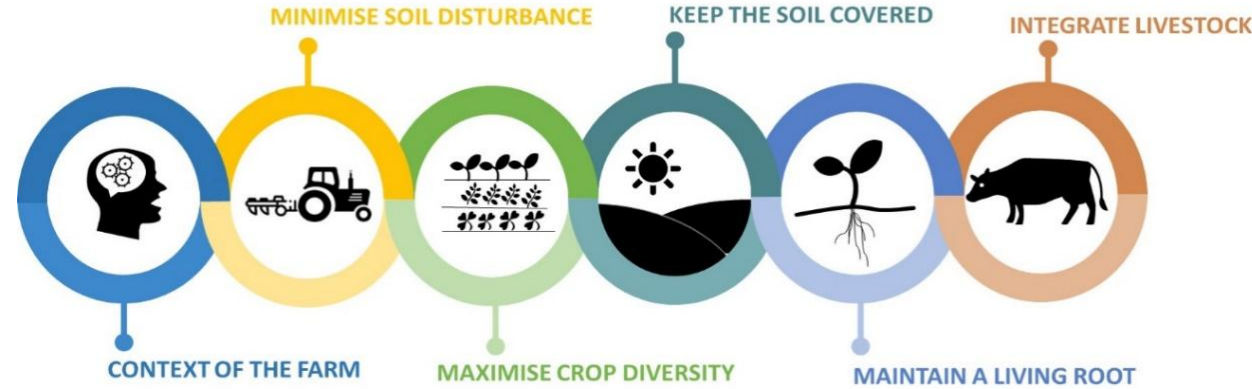
Kellie E. Smith, Ruth N. Wade, Martin Gilpin, Holly Armitage, Richard Grayson, Lisa Collins, Bob Doherty, Pippa J. Chapman

Regenerative agriculture trial

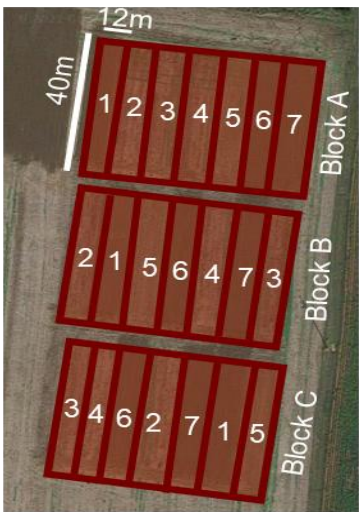


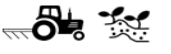
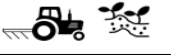




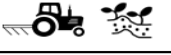



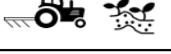







*“Regenerative agriculture has at its core the intention to **improve the health of soil** or to **restore highly degraded soil**, which symbiotically enhances the quality of water, vegetation and land-productivity.”*
 (Rhodes, 2017)

SIX PRINCIPLES OF REGENERATIVE AGRICULTURE



Aim: to demonstrate and measure the impacts of different transition strategies to regenerative agriculture



Treatment number and principles followed	
1	Conventional farming: no RA principles followed
2	Minimise soil disturbance & keep the soil covered 
3	Trt 2 + increase diversity  
4	Trt 3 + integrate livestock   
5	Trt 4 + maintain a living root all year round    
6	Change in cereal rotation to include herbal ley    
7	Long-term herbal ley    



THE MARK LEONARD TRUST



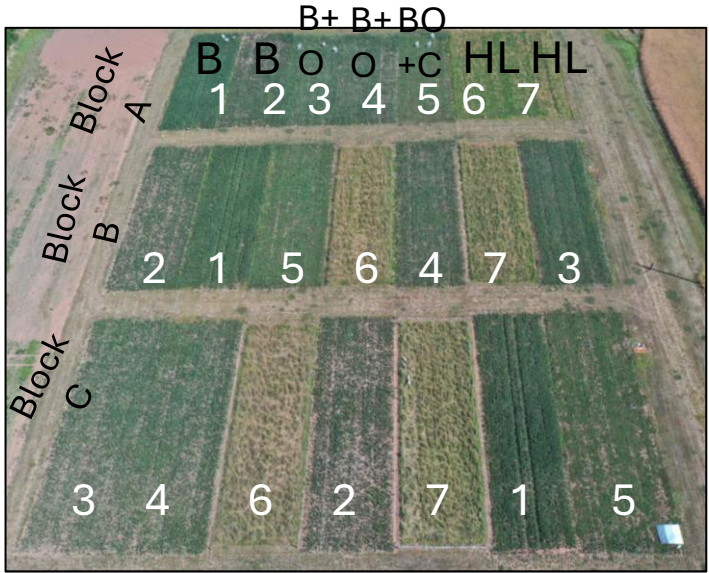
Regenerative agriculture trial 2025

Three years into trial:
 Winter wheat (2022-2023)
 Spring barley (2024)

Spring beans and oats (2025)

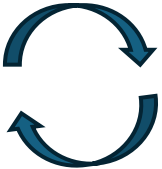
Winter wheat (2025-2026)

Intercropping beans with oats.
 In trt 5 clover is also growing = 3 plants.



Treatment number and principles followed	
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Beans - add N to soil.



Oats – cover soil.

Measurements:

- Crop
- Pests/disease
- Weeds

Beans and oats sown



March 2025



Beans and oats harvest



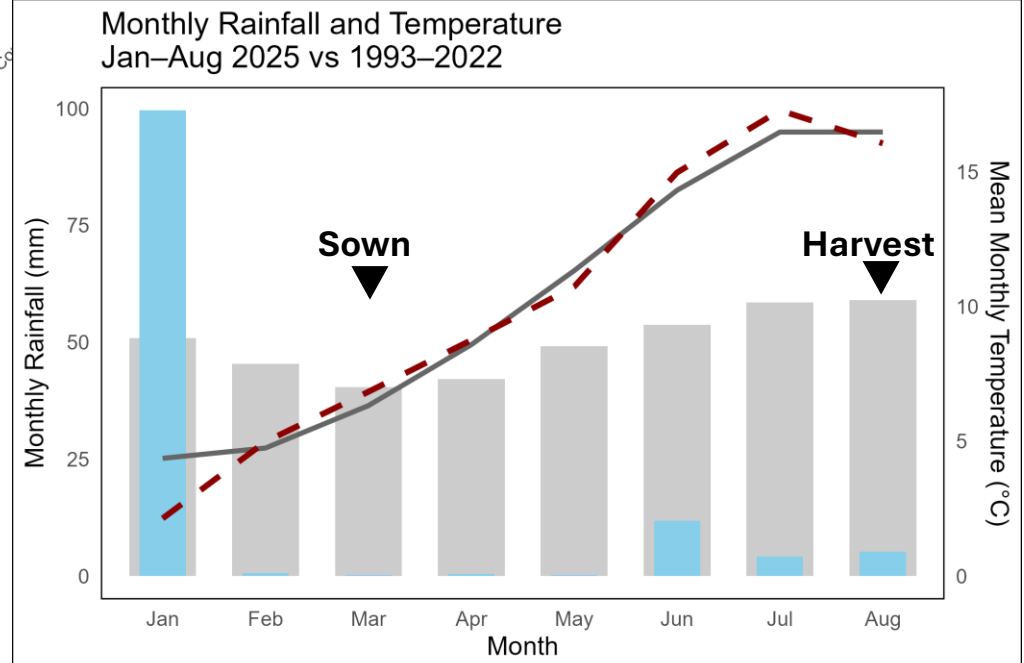
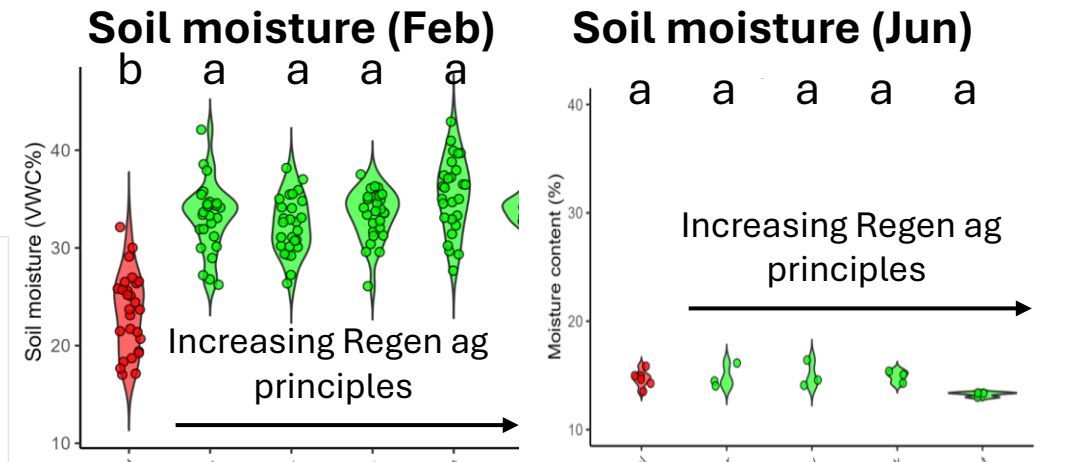
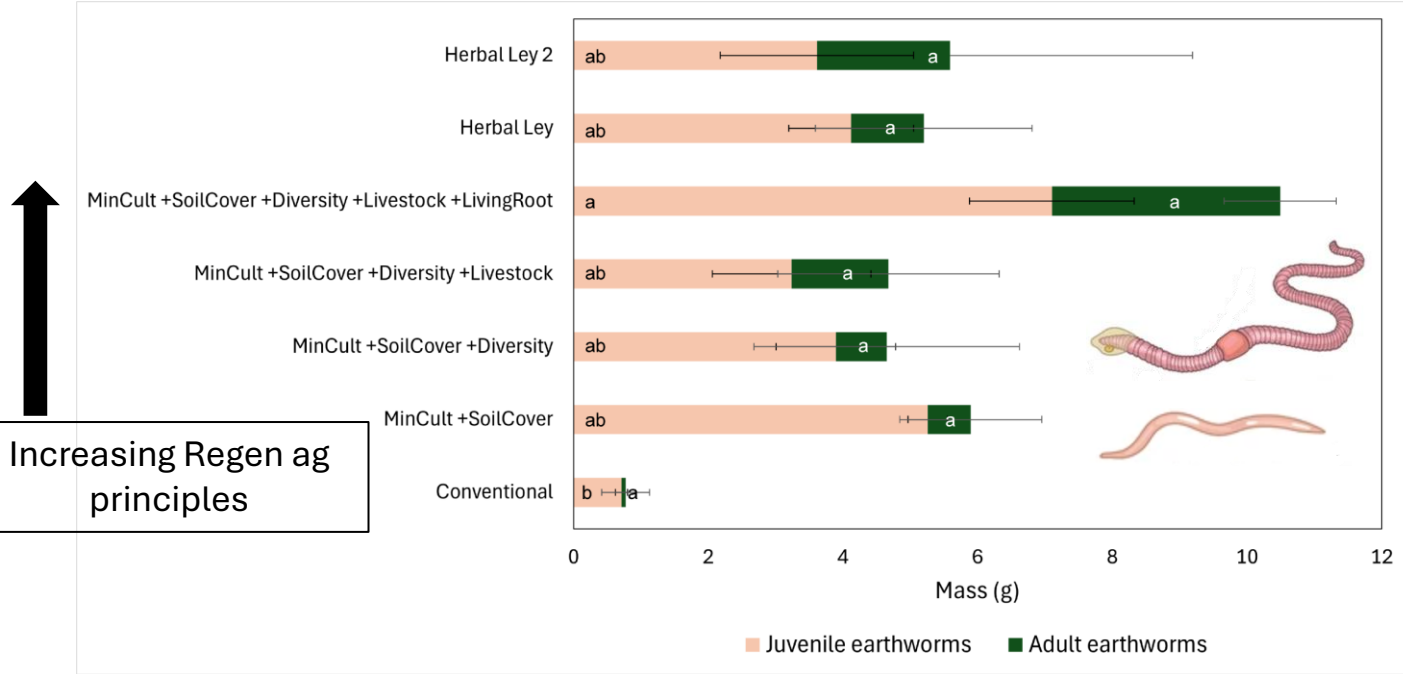
August 2025



Hypothesis: Do we boost land productivity or increase resilience e.g. to pests, weeds and climate when adding plant diversity?

Soil & weather context

Worm counts (Feb)



- Drought year.
- Regen ag plots started with more **moisture** and **worms**.
- Soil dry in all by mid growing season.





**Plant productivity and resilience in
intercropped systems**

Plant resilience

- Similar bean and oat numbers **early establishment** across trial.
- Plots with oats and clover (trt 5) had fewer beans per area but **less damage** from pest feeding.
- Beans in **monocrop conventional** did better **later** in the season.

Conventional (trt 1)

No plough (trt 2)

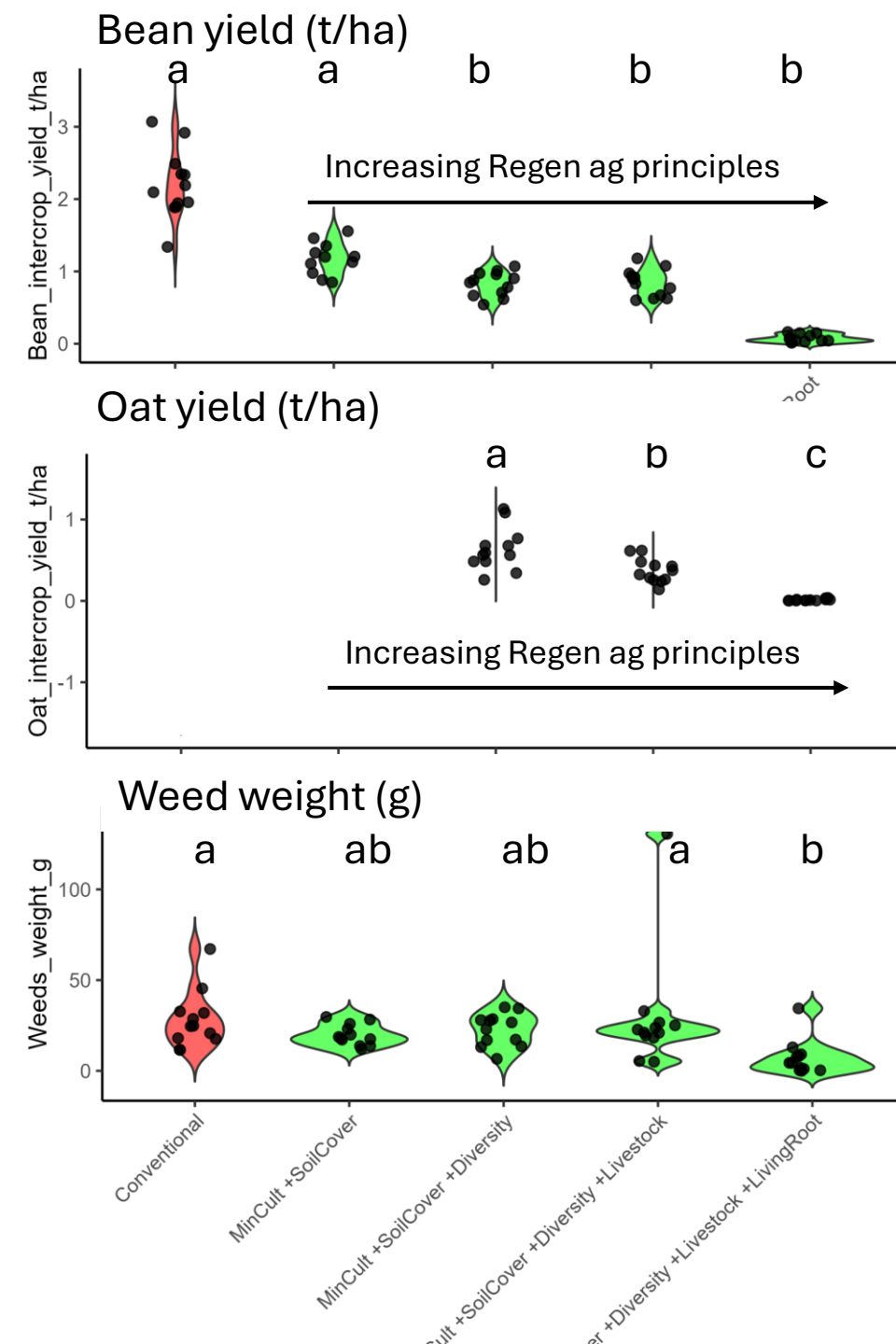


Beans – Conventional (trt 1)

Beans - No plough (trt 2)



Crop yield



- Higher bean yield without oats.
- From oat plots, oat yield decreased with increasing RA principles.
- Lowest yields from trt 5.
- More weeds in conventional and least in trt 5.
- Land equivalent ratios (LER).

	Treatment		LER
1	Conventional		1
2	MinCult +SoilCover		0.9
3	MinCult +SoilCover +Diversity	Oats →	0.37
4	MinCult +SoilCover +Diversity +Livestock	Oats →	0.36
5	MinCult +SoilCover +Diversity +Livestock +LivingRoot	Oats →	0.03

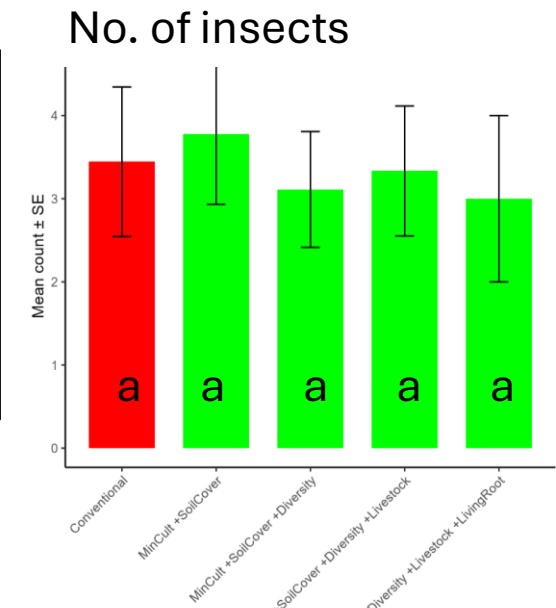
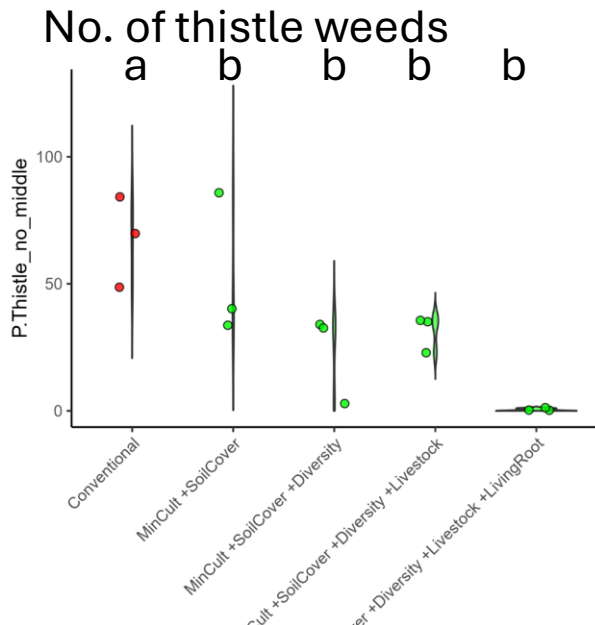
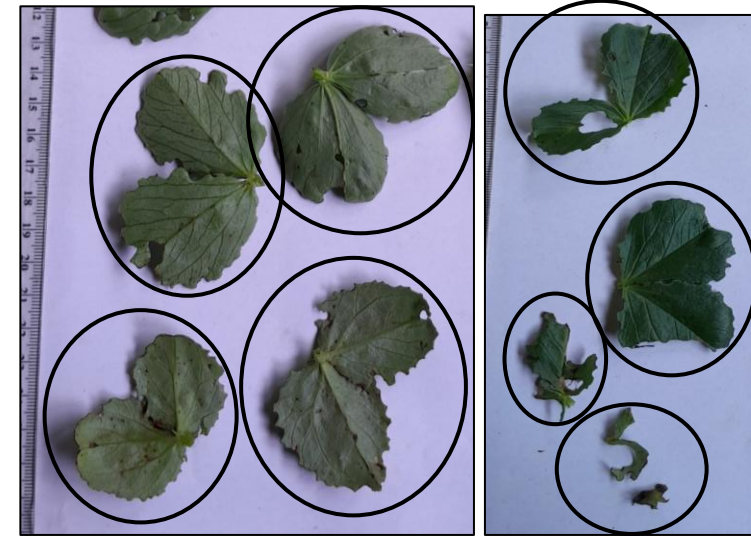


Pest resilience when intercropping

Pests, predators and weeds

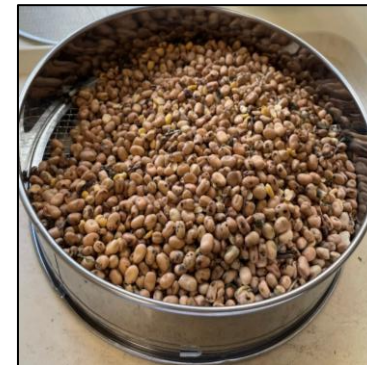
- Conventional beans had larger less damaged leaves.
- No difference in pest insect numbers.
- More ground beetle predators in conventional plots.
- More thistle weeds in conventional.

Leaf feeding damage



Summary and next steps

- Regen ag plots **promising** at start of year.
- **Extreme** climates is a real issue for agriculture.
- Companion cropping not successful due to **drought** this year.
- Early in Regen Ag **transition** (Year 3).
- Soil health is **slow** progress to undo damage.
- There is need for **long-term** regen agriculture trials.
- **Context**-dependent results.



Thank you to the team

Martin Gilpin
Holly Armitage
Leonard Doehl
Richard Grayson
Ruth N. Wade
Pippa J. Chapman

Bob Doherty
Lisa Collins

Rachel Gasior
David Ashley
Sarah Hunt
Josh Greenwood

Jarrold Benson
Will Homewood



UNIVERSITY
of York



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Joseph Martlew
Stewart Ritchie
Kizito Msekiwa





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The H3 Project: Results of a four-year quasi-experiment measuring impacts of regenerative agriculture transitions in England

Katherine Berthon
Department of Zoology, University of Cambridge

Soil Health

Do regenerative practices improve soil health?



Earthworm
Density

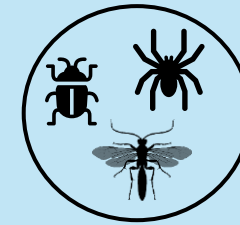


Physical
Properties

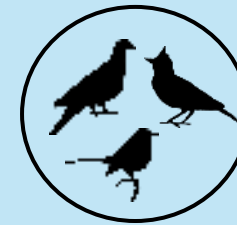
Co-Designed Farmland Experiment

Ecology

What are the wider environmental benefits of regenerative agriculture?



Natural
Enemies



Winter
Birds



Pollinators

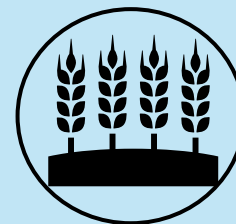
Social Science

What are farmers' perspectives on regenerative agriculture in the current policy environment?



Farmer & Policy
Interviews

Inputs, Yield and Nutrition



What is the impact on crop inputs yields and nutrition?

For detailed methods
see Berthon *et al* (2024)





What are farmers' perspectives on regenerative agriculture in the current policy environment?



Farmer's Perspectives

2022



Various definitions – soil-centred, diverse practices

'no textbooks on how to do this'



Economic vs
Environmental motivations

*'there's a fine line ... between evidence
and witchcraft'*



Current policy context
is very uncertain

'fiendishly difficult to navigate'



For more details see
Beacham et al. (2023)



Farmer's Perspectives



2022



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'there's a fine line ... between evidence and witchcraft'



Current policy context is very uncertain

'fiendishly difficult to navigate'

2025



Different time horizons of regenerative agriculture

'You'd need to do 10 years of it in order to be able to build that picture'



Intergenerational differences

'He's more adventurous because he probably doesn't fully understand the risks'

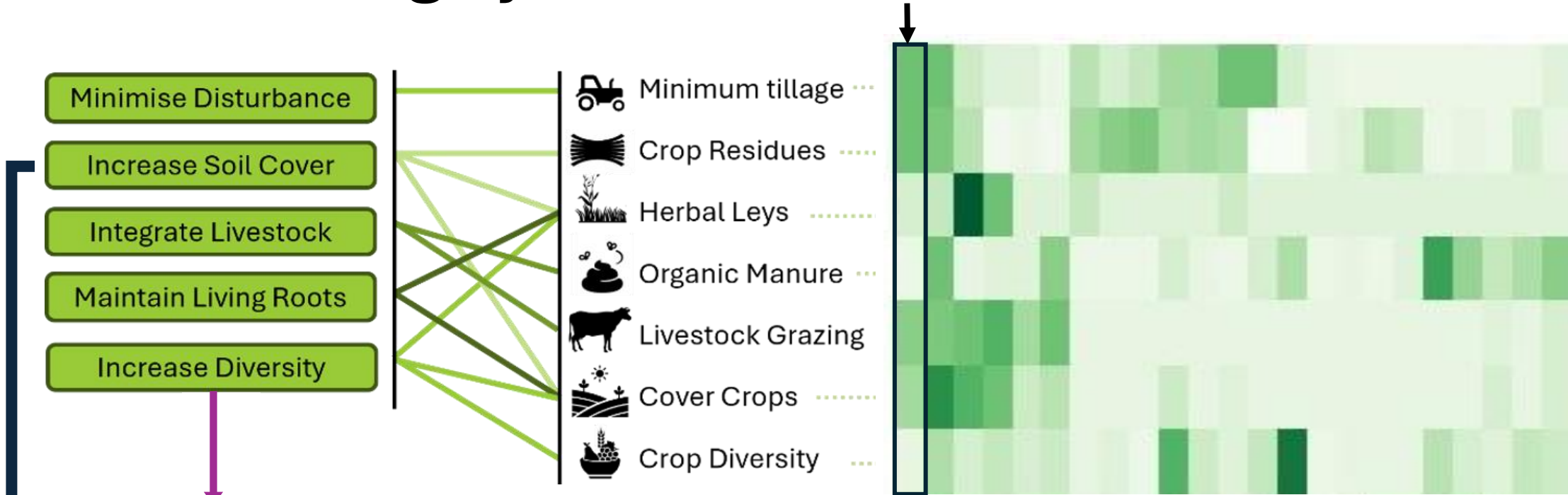


Uncertainty in weather *and* policy

'the weather can come and screw you right up at the last minute'

H3 Scoring system

Farm Fingerprint



Summed relative frequency of constituent practices over five years → **score** between 0 and 1 for each principle

$$\text{Regenerative Score} = P1 + P2 + P2 + P4 + P5$$





Do regenerative practices improve soil health?

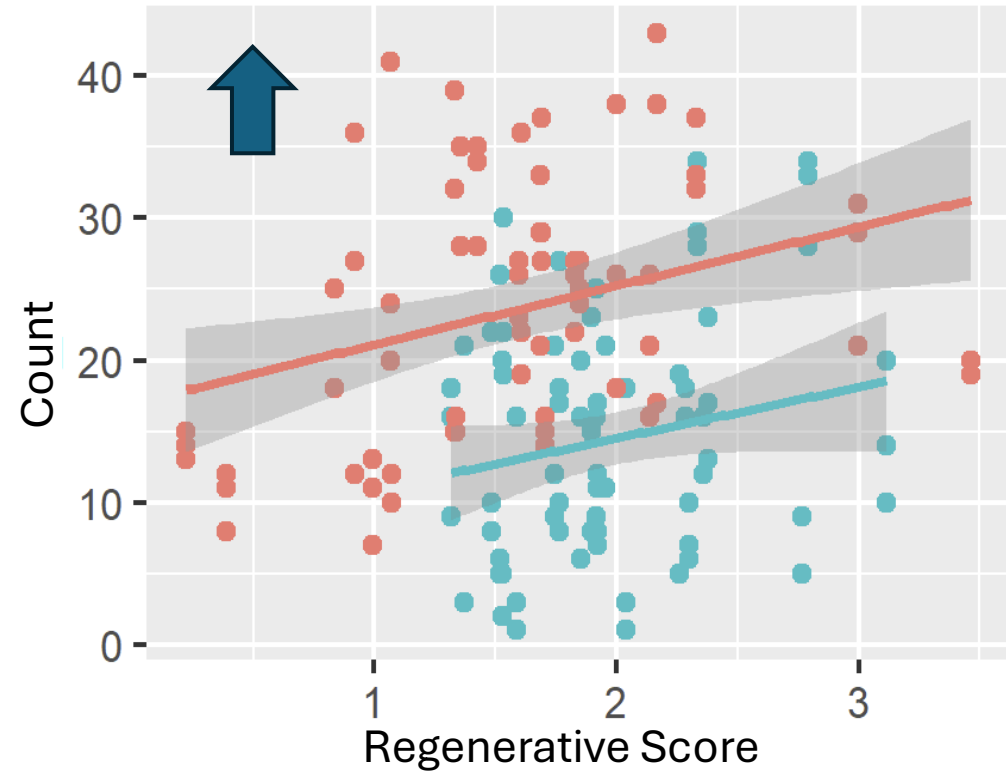


Photo Credits: Coline Jaworski, Charlotte Foote, Jayna Connelly

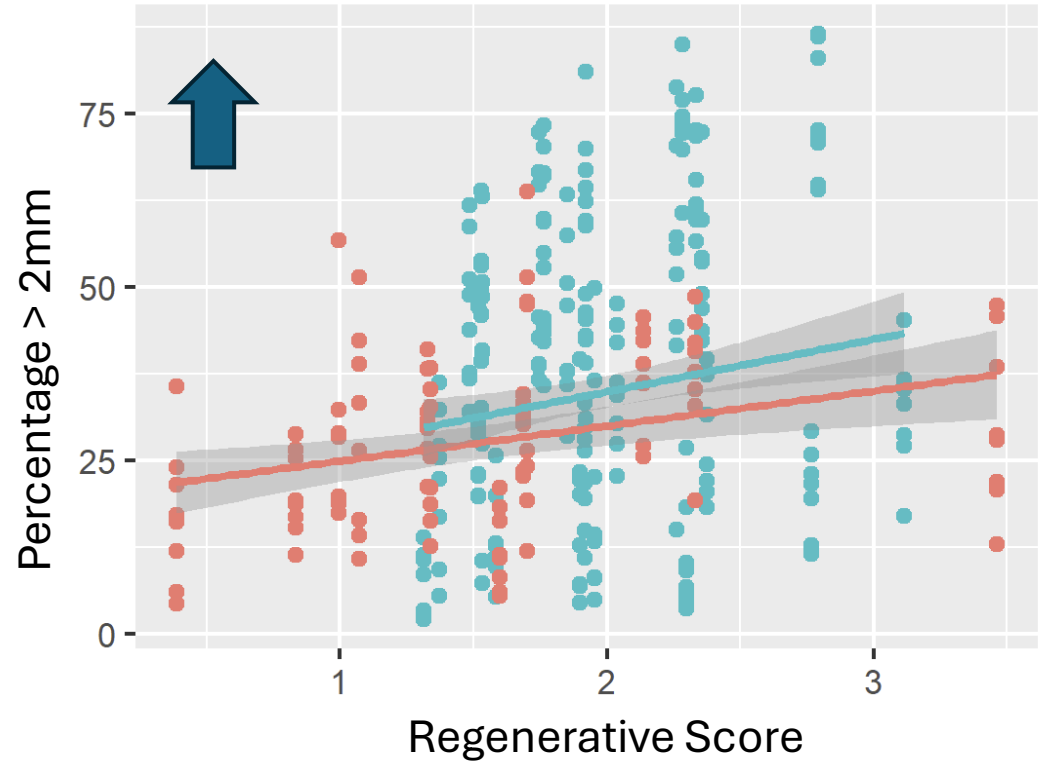
Results: Soil Health



Total worms



Water Stable Aggregates



Cluster
East
Southwest

Effects vary across years and soil types

Soil benefits from **increased soil cover** and **decreased tillage**



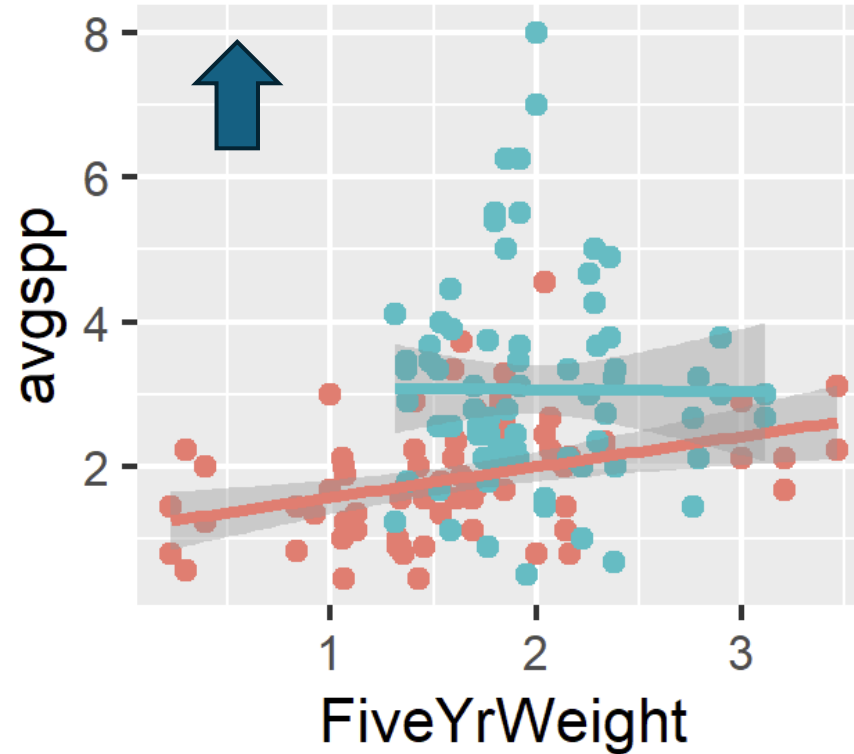
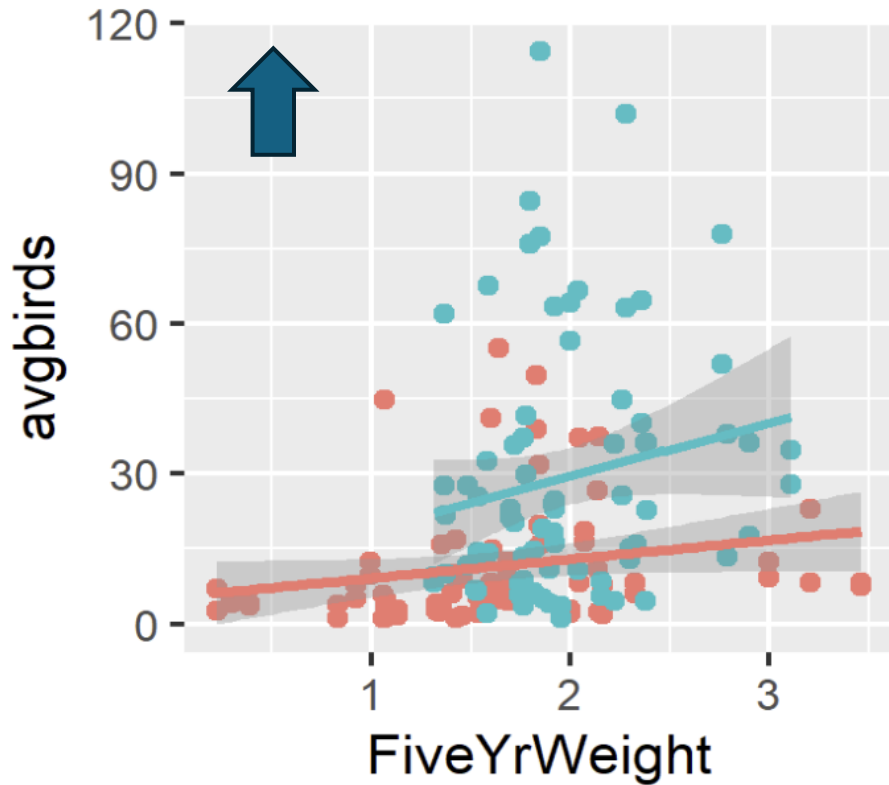
Do regenerative practices improve biodiversity and ecosystem services?



Results: Winter Birds



Increases in bird abundance and diversity

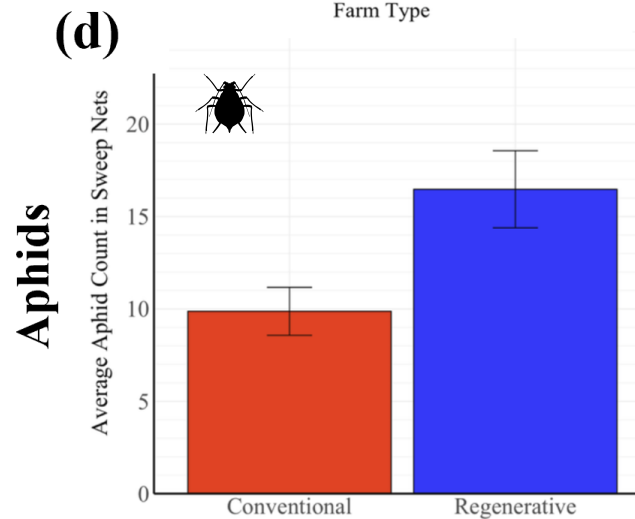
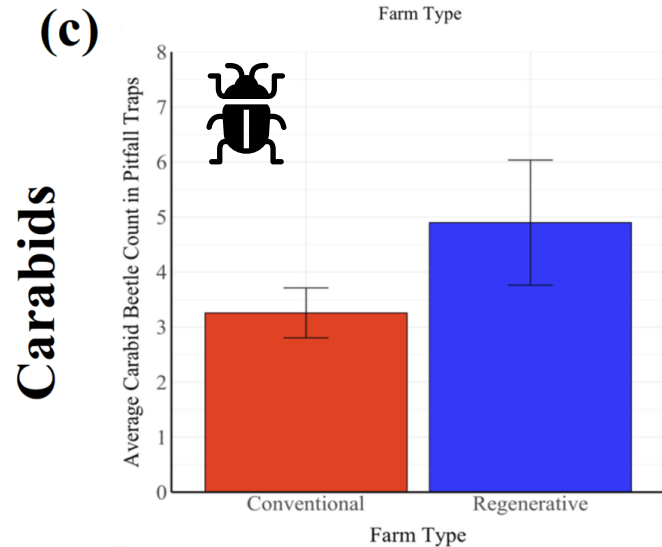
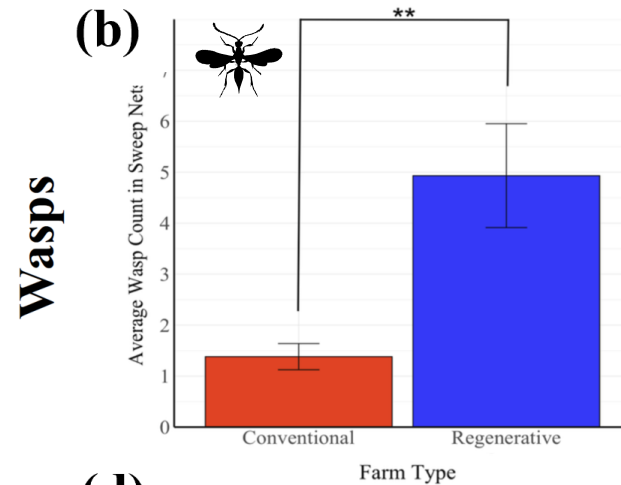
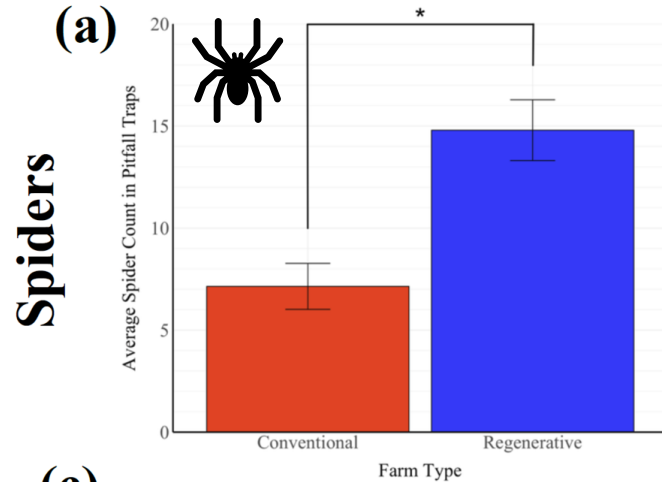


Cluster

- East
- Southwest

Birds benefit from **crop diversity** and **decreased tillage**


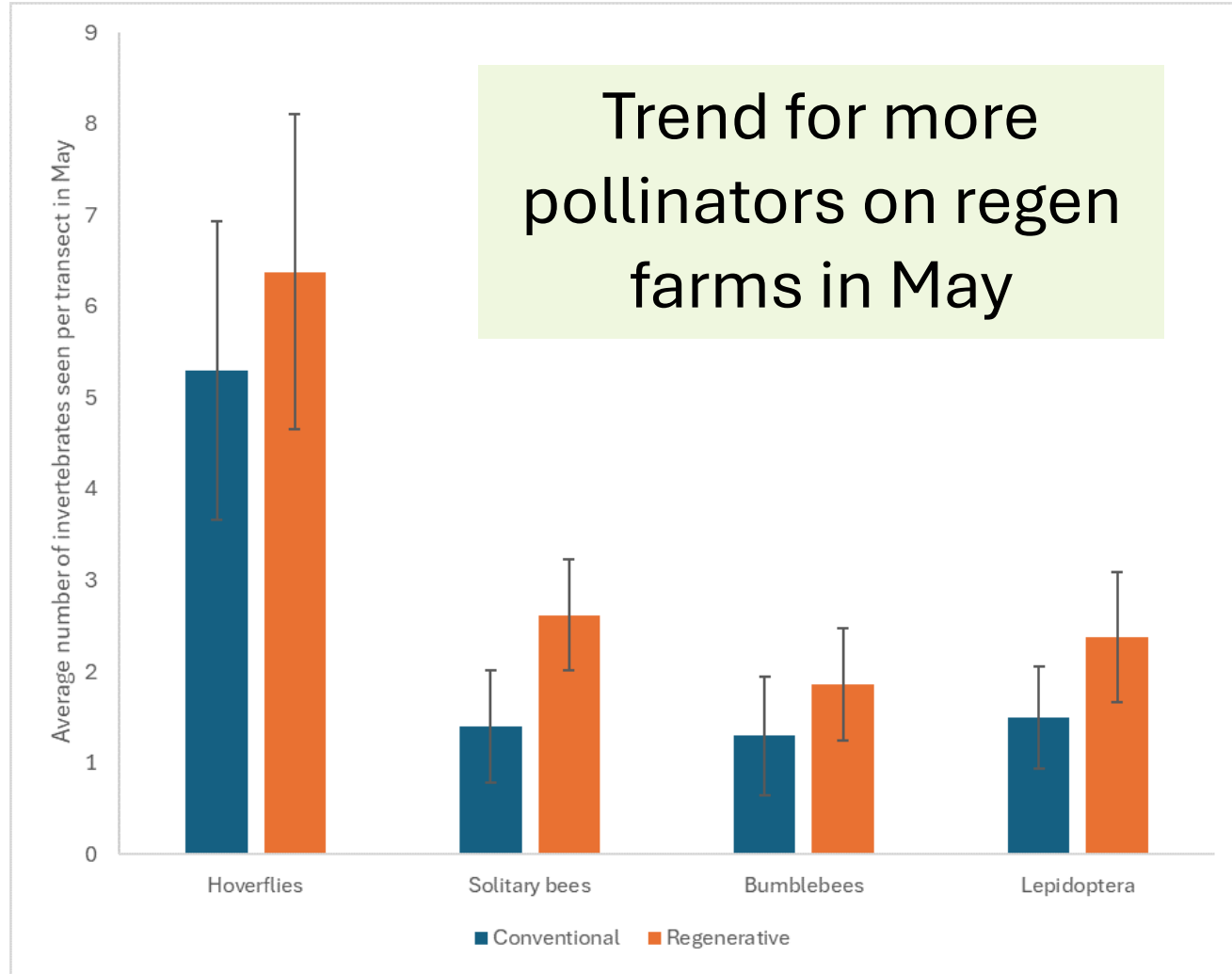
Results: Natural Enemies and Pests



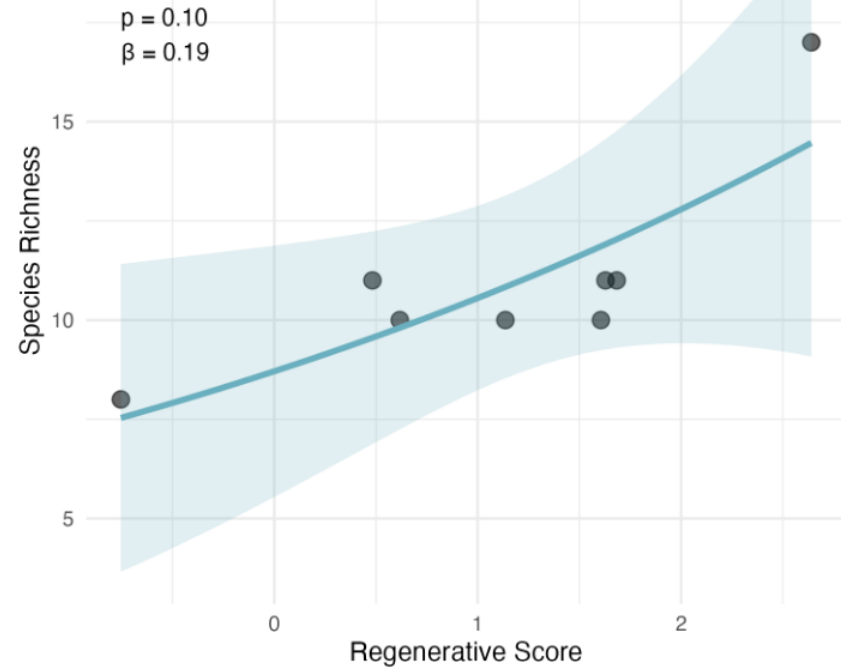
More spiders and parasitoid wasps on regen fields BUT more aphids

Some beetles benefit from regen, some from conventional tillage

Results: Pollinators



And more spring flying ground nesters

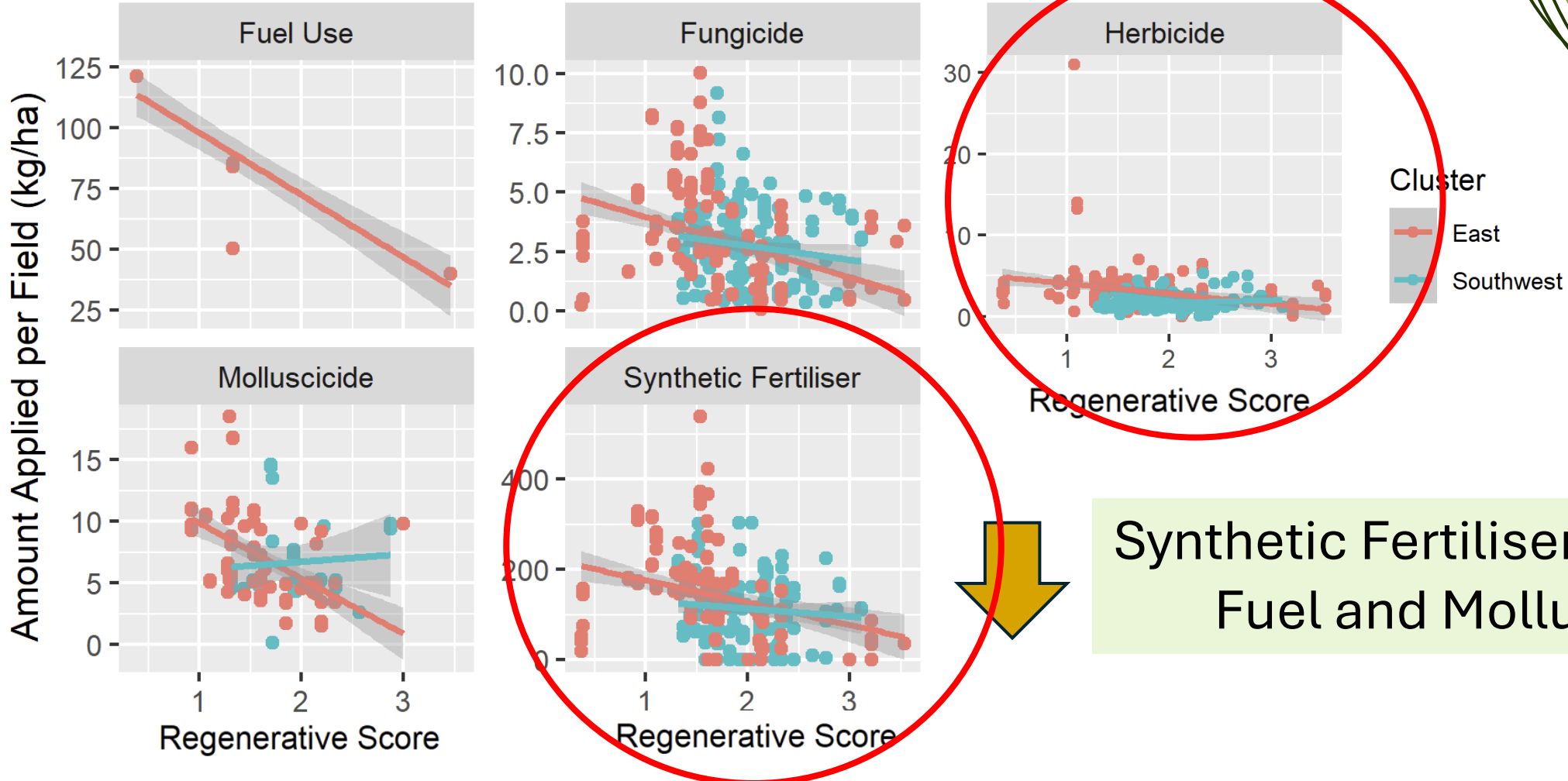




What is the impact on crop inputs yields and nutrition?

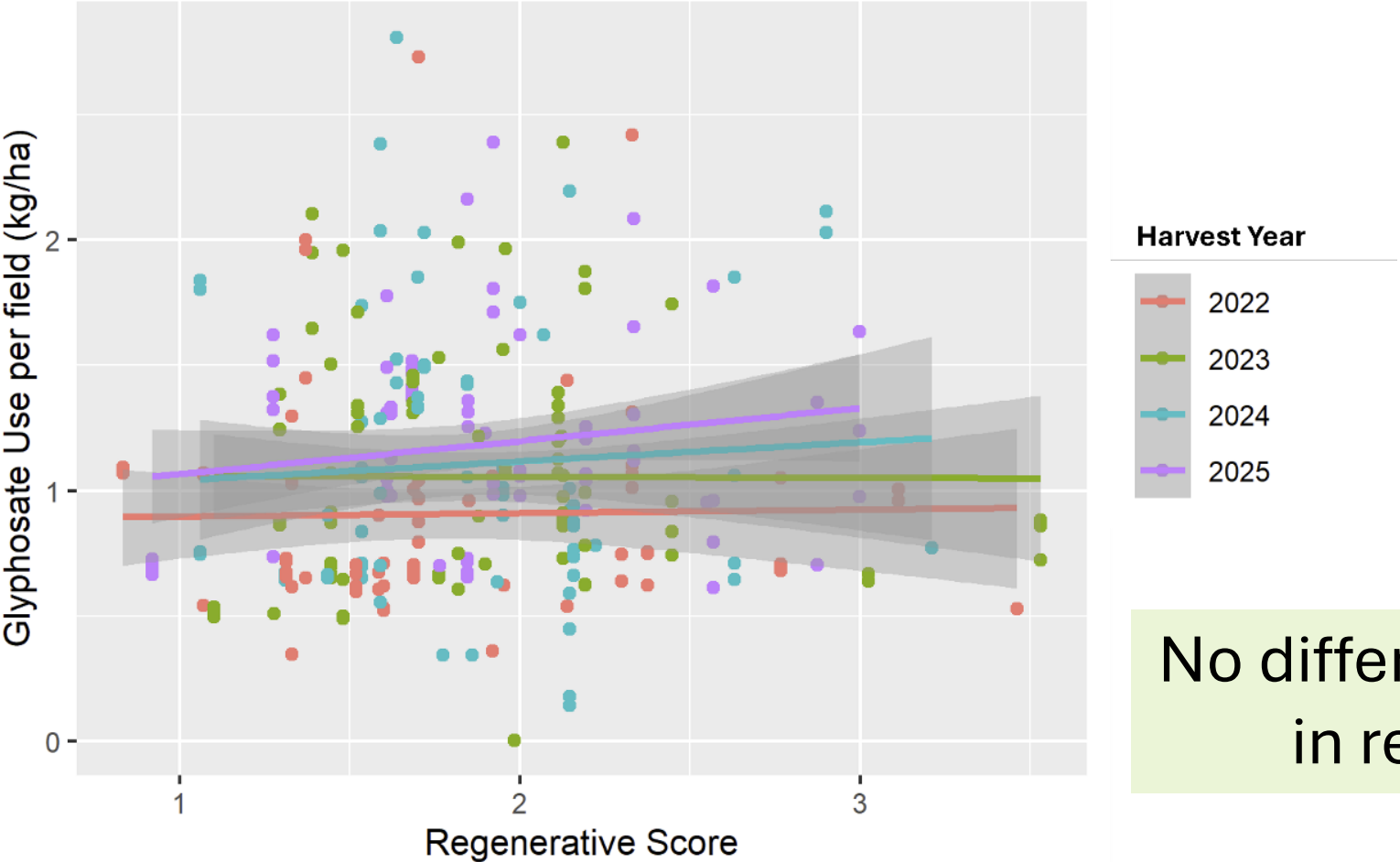


Inputs



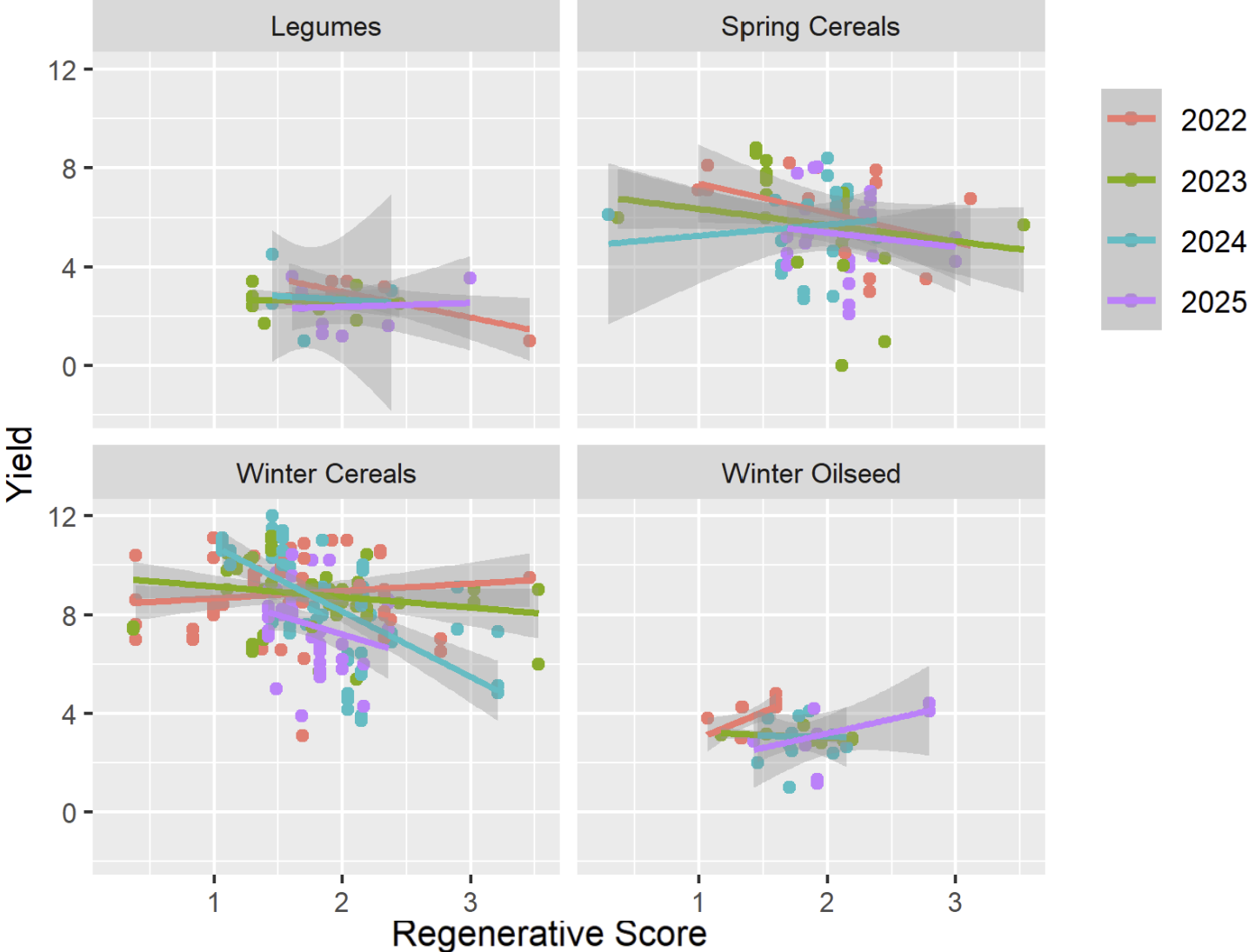
Synthetic Fertiliser, Fungicide, Fuel and Molluscicide

Inputs: Glyphosate Use



No difference in herbicide use in regenerative farms

Crop Yield



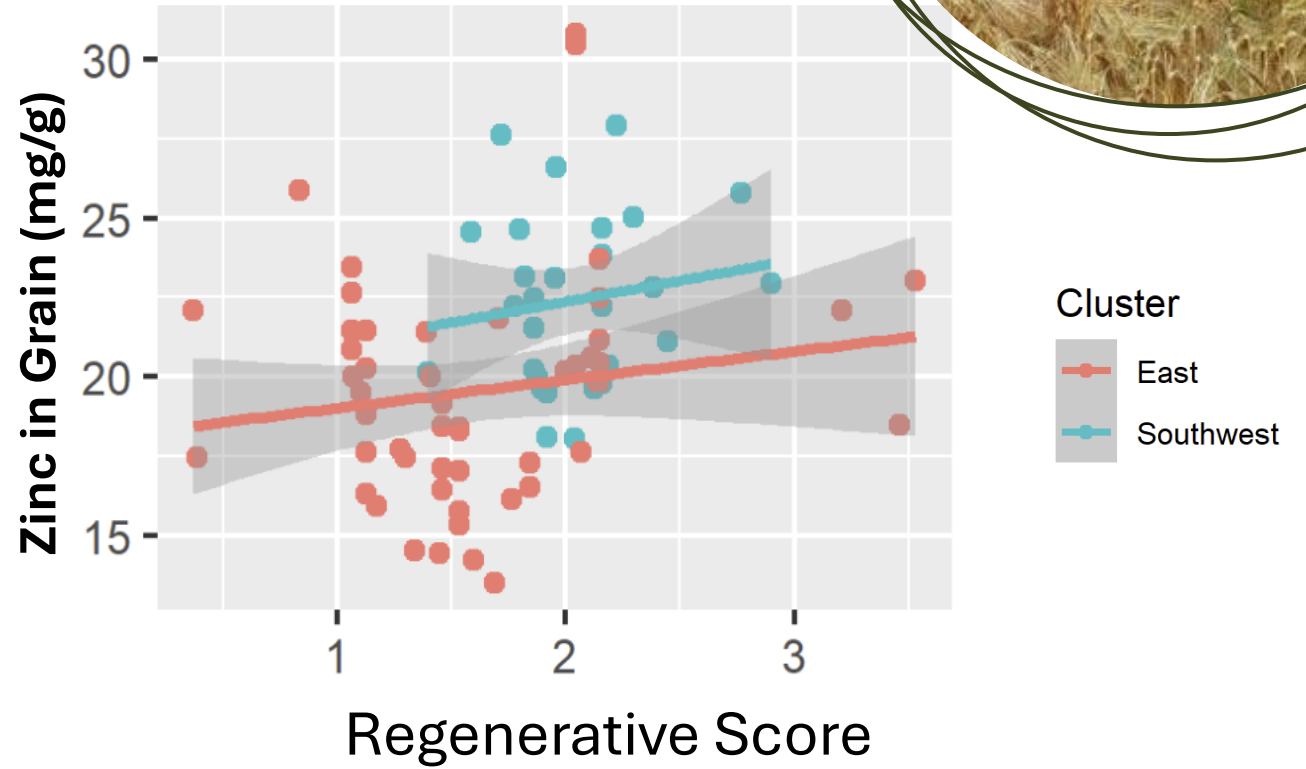
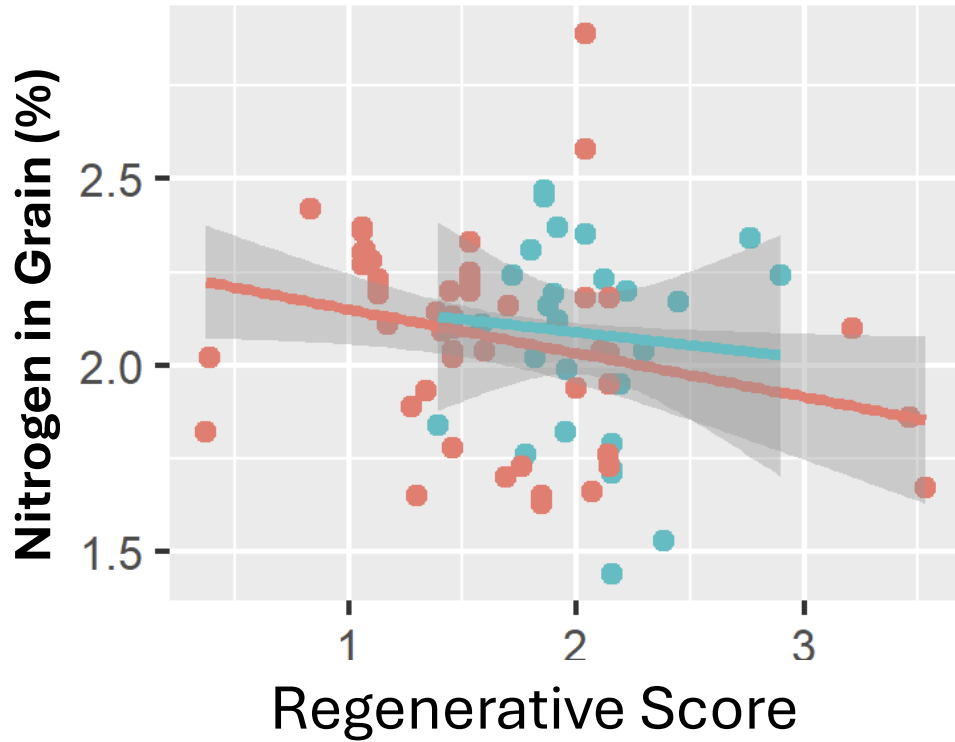
Yield Penalties higher in more recent years

Yield Changes – Winter Wheat



Yield Penalties higher in more **recent years** and on **clay soils**

Nutrition: Nitrogen and Zinc



Summary of findings so far

↑ Improved **soil health** (worms, carbon storage), more **birds**, more **spiders**

•••▶ Effects on **insects** strongly influenced by landscape features

↓ Less **mineral fertilizer** used on regenerative farms

↓ **Yields** lower BUT decreased **input costs**

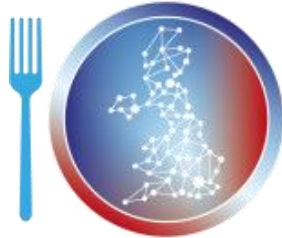
Effects on long term **productive capacity**? Hard to measure.
Quantifying 'regenerativeness' is an important first step

Farmers need **financial support** to make this transition and share knowledge about how to do it





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**TRANSFORMING
UK FOOD
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Strategic Priorities Fund



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CAMBRIDGE**

Thank You!

www.h3.ac.uk

Coline Jaworski

Lynn Dicks

Niamh McHugh

Lucy Capstick

Eleanor Ness

Yu Zhao

Tim Daniell

Penelope Watt

Jonathan Leake

Peter Jackson

Jonathan Beacham

Anne Blenkinsopp

Alexander Cumming

Edward Cheng

Lab team: Ellie, El,

Ella, Mel, Annie

**Ecology, Agronomy &
Data collection**



Stakeholders



**Soil ecology
Social sciences
LCA**



Farmer Cluster Coordinators



Farming &
Wildlife
Advisory
Group



@CityKat75 Email: kb809@cam.ac.uk



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HEALTHY PEOPLE

Farmer perspectives on the transition to regenerative agriculture: barriers, opportunities and economic dimensions

Peter Jackson, **Jonathan Beacham**, Katherine Berthon, Anne Blenkinsopp, Lynn Dicks, **Pippa Chapman**, Ruth Wade



Two rounds of interviews...

- ... in 2022 and 2025, to explore **farmer perspectives on the transition(s) towards regenerative agriculture**
- Two farmer clusters, in Cambridgeshire and South West
- Team effort, with 24 farmers taking part (14 and 10 respectively)
- First round of interviews summarised in *Journal of Rural Studies* (2023), focusing on contextualising regenerative transitions in shifting agricultural paradigms
- Peter Jackson leading the analysis of the second round of interviews, focusing on **different time horizons**

Key analytical themes

- Long timeframes required to judge the impact of introducing regenerative practices (on yield, profitability, soil health and biodiversity) – compared to short-termism of government policy and volatility of economic markets
- Different speeds at which innovations can be introduced and the challenges of changing tack once initial investments have been made
- Generational differences in attitudes towards regenerative agriculture (and the uncertainty around proposed changes to inheritance tax)
- Unpredictable impact of climate change and weather events (*We're only as good as the weather*)
- Managing risk and variations in how farmers see the future



Different timeframes of intensive and regen ag

- Regen ag works on longer timeframes than conventional (intensive) farming
- Need a long time to judge the effects of shifting from one to the other:
 - *We're trying to [farm] more regeneratively, but at the moment I can't see any results from that because I think [3-5 years] is way too short. I think we should be talking at least 25 years*
 - *To get that kind of [yield] benefit out of regenerative farming, you'd have to have been doing it for about 20 years*
 - *We've some things we're going at slowly but in a kind of sustained fashion, like reducing artificial fertilizers, and reducing our fungicide applications and stopping our insecticide applications. And then some things happen quite fast like doing companion cropping and that sort of thing. Some stuff takes like two or three years from planning and inception to implementing... You can't do all areas of regen ag in the same speed, so you kind of pick a few and go for them*

Generational differences

- Older farmers more reluctant to change?
 - *I've been doing it all this time and we're doing OK. So I'm not gonna risk rocking the boat [by changing to regenerative agriculture]*
- Parents and children with different perspectives?
 - *He [the son] is tweaking things... he wants to be tidier than I am. And more inputs are going on because he's worried. I find the younger generation listen to salesmen a lot more, the same as I would have been years ago. And like, oh, there might be a disease risk. I'd better put this on rather than taking some ownership and stepping back a little bit. But he will find his feet. He'll understand in time that balance*
- Younger generation more willing to experiment?
 - *He's more adventurous because he probably doesn't fully understand the risks'*

Seasonal variations and unpredictable weather

- **Hard to judge the impact of regen practices because of other factors such as variable weather:**
 - *There's been enough normal difference between yields in every year not to really expose any very low yields from regen farming... And it's tricky to tell the differences because we've had such a weird, very wet year and then a very dry year*
 - *I don't think the yield has changed much... Last year was a poor harvest, but it was a poor harvest because of the wet and the poor, poor weather in June*
- **Need to be flexible:**
 - *We've still got the ploughs in the shed and if, for any reason, we felt we needed a reset, they'd come out and do the job*

Government short-termism

- Scepticism provoked by sudden changes to SFI:
 - *We seem to live in such short periods of time now. You can't plan like you used to be able to*
- And low expectations of future food policy:
 - *We've had a food strategy before, which Henry Dimbleby did, which was put in the bin as soon as he spent all this money. I don't want any [new] strategies because they cost hundreds and thousands, if not millions of pounds to develop a paper that then no one even reads*
 - *In terms of future food strategy, you'd just like them to commit to something for a length of time. So you know where you start, you know, that for the next three to five years, this is how, if there's going to be limits or caps, then those are in place at the start. Don't keep changing the ground rules ... it's just having things and knowing where you stand*

Managing risk and future uncertainty

- A constant process of managing risks:
 - *For me ... it's about evaluation at the end of the season, learn lessons and move forward. Can we get a cover crop in earlier? Did we use the right mix? Did we choose the right drill? ... So we often blame the pest or the weather, when actually we've picked the wrong tool, but we don't know until two months after we've done it. So it's this constant evaluation of trying to work out what's best*
- Some farmers express confidence in what they're doing:
 - *I've never been as confident in [regen ag] as I am now... You need to have the knowledge in place and then have the confidence to enact it*
- Others are worried about the future of farming:
 - *I'm very worried about the future, really. There's no obvious direction, really, to go... I'd very much like there to be another generation, but with inheritance tax, that's quite tricky. It is fundamentally not very profitable, really, farming*

Summary

- Analysis of round 2 interviews on-going – all **analyses are tentative**
- Understandings of different (possible, probable and potential) transitions need to be grounded in **what is happening ‘on the ground’**
- **No single journey** towards regen ag, wide range of experiences
- **Working across disciplines** is important: social science research supports findings of the environmental monitoring (e.g. over small-scale variations, from year to year, farm to farm, field to field)
- Government policy needs to take account of the different time horizons reported here – develop **more consistent, long-term strategy**

Risks of Transitioning to Regenerative Agriculture

- Increased weed and pest pressure
- High upfront financial costs
- Operational and technical complexity
- Social and cultural resistance
- **Initial yield reduction**
- **Impact on profitability**



(Credit: Alison Day)

Sustainable Farming Incentive (SFI)

Handbook for the SFI 2023 offer

www.gov.uk/defra/sustainablefarmingincentive

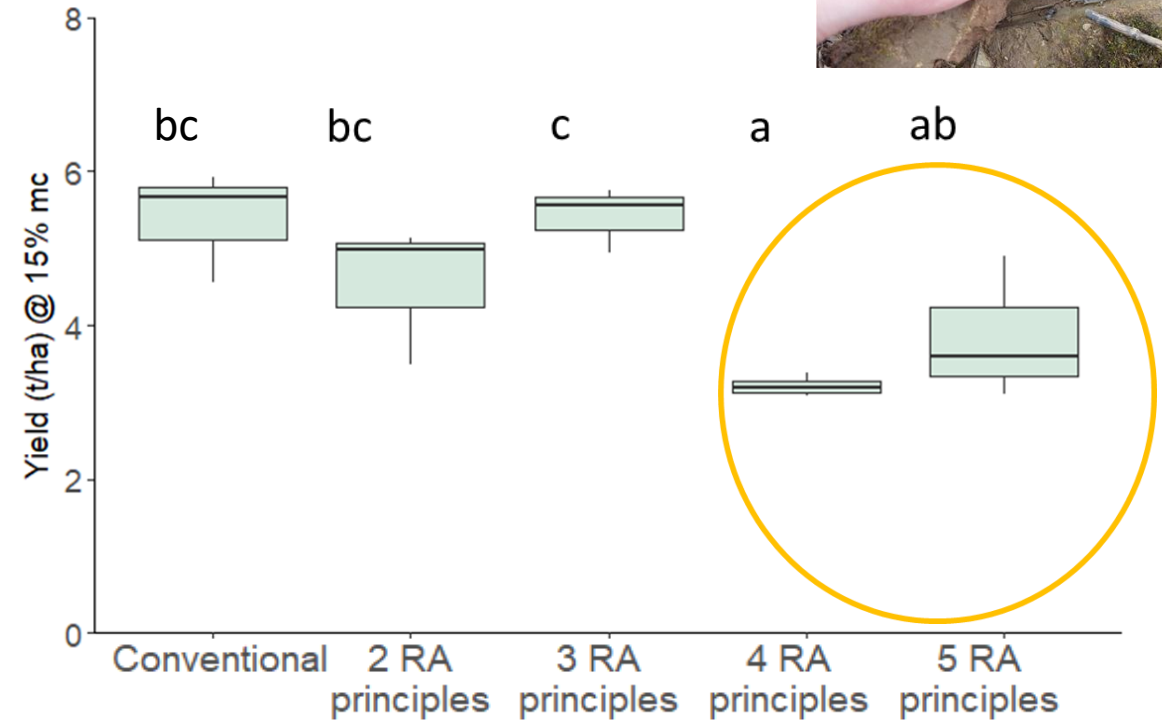
Crop yield – Year 1 & 2

2022-2023: Winter Wheat



Average yield across England = 8.1 t/ha

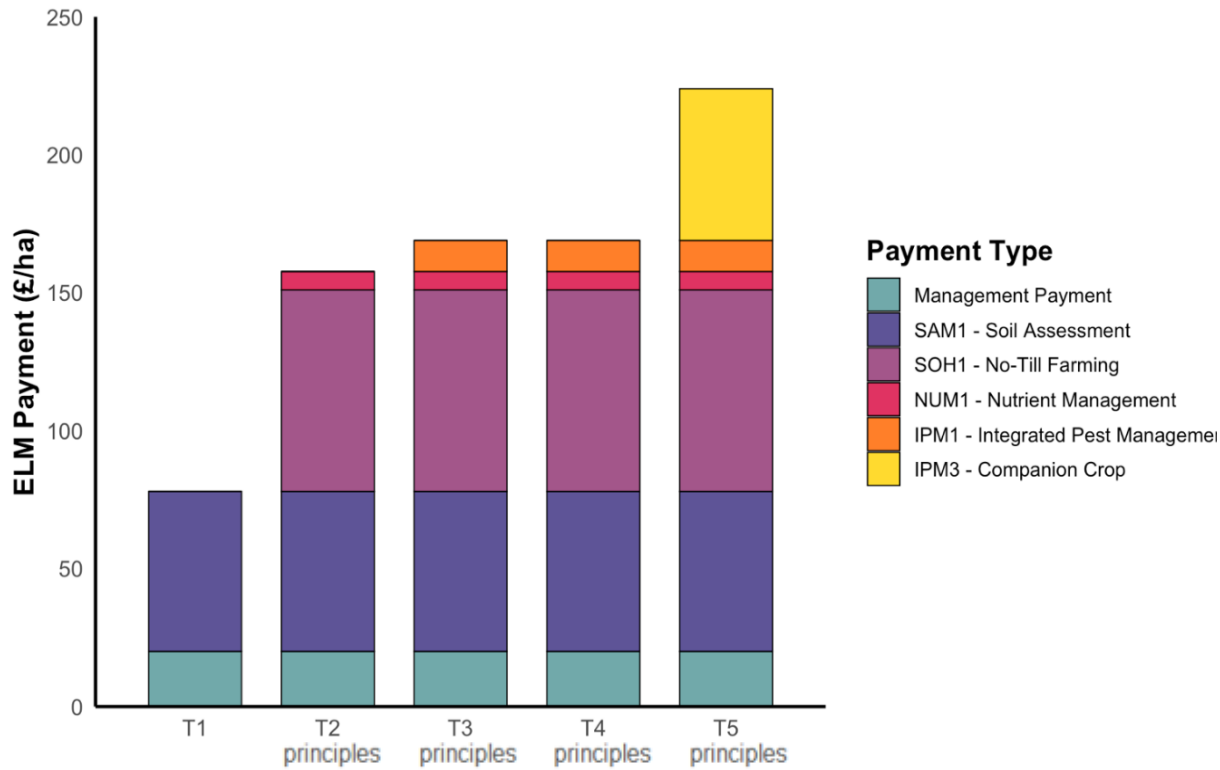
2024: Spring Barley



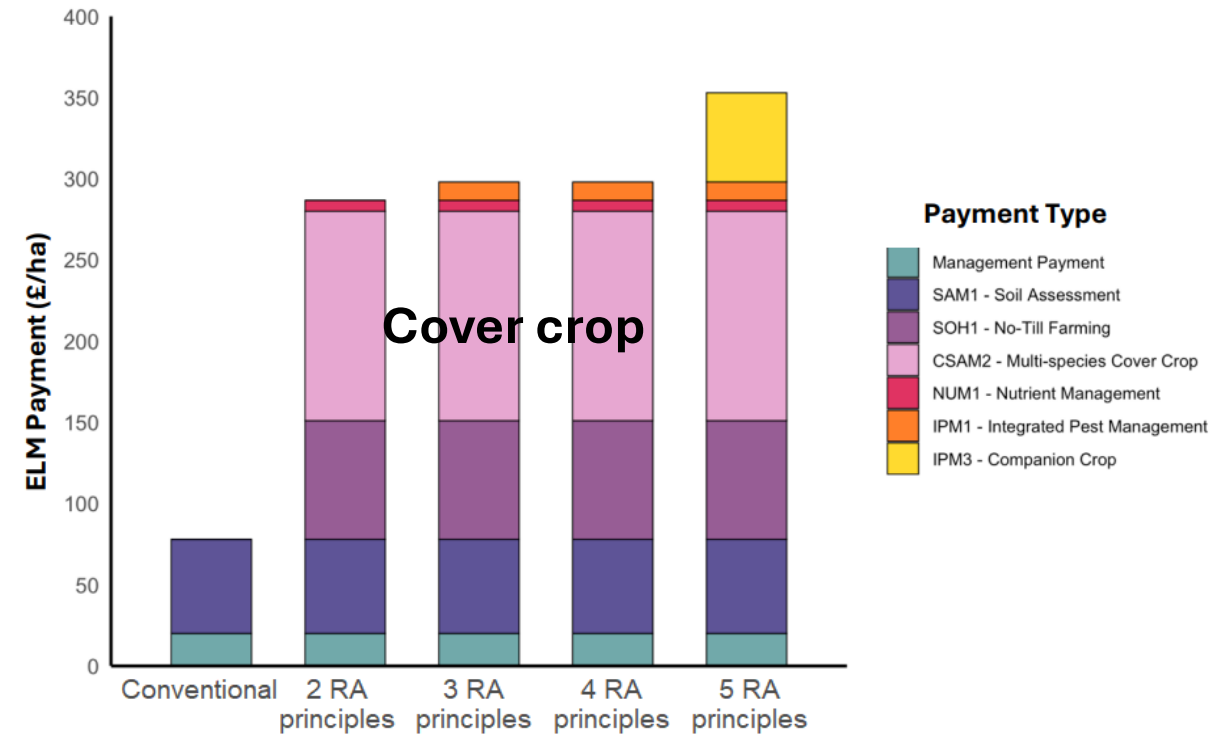
Average yield across England = 4.4 t/ha

Environmental Land Management Payments – Sustainable Farming Initiative (SFI)

2022-2023: Winter Wheat

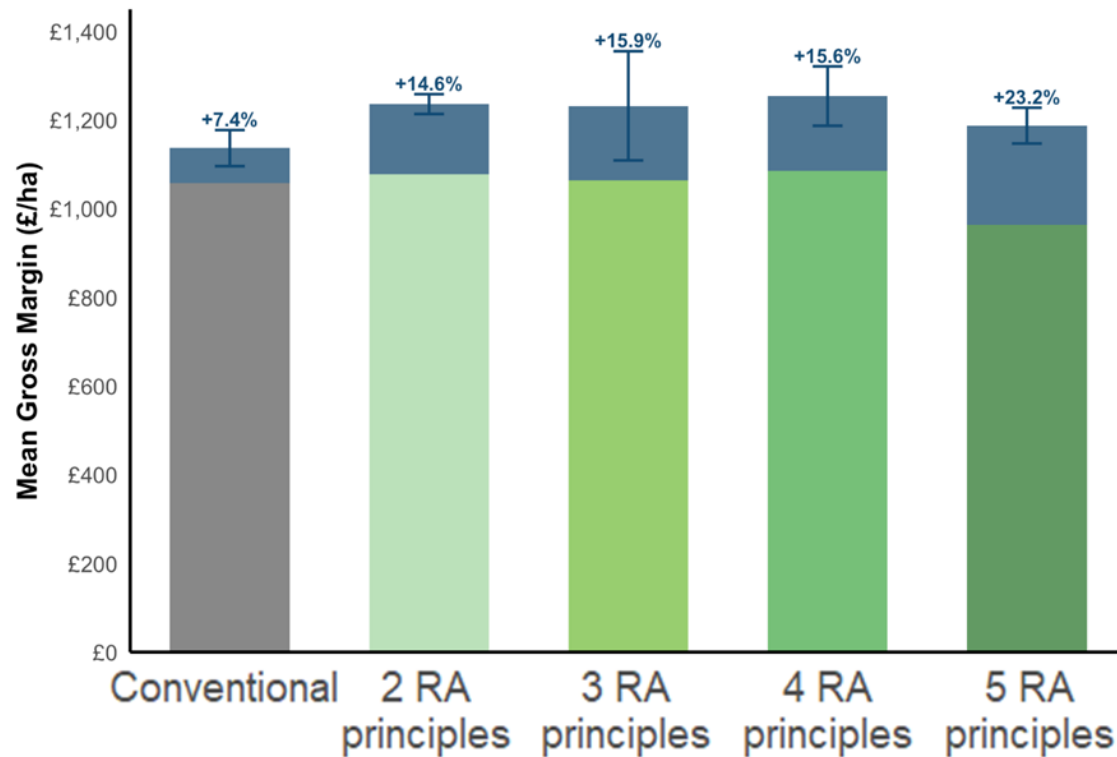


2024: Spring Barley

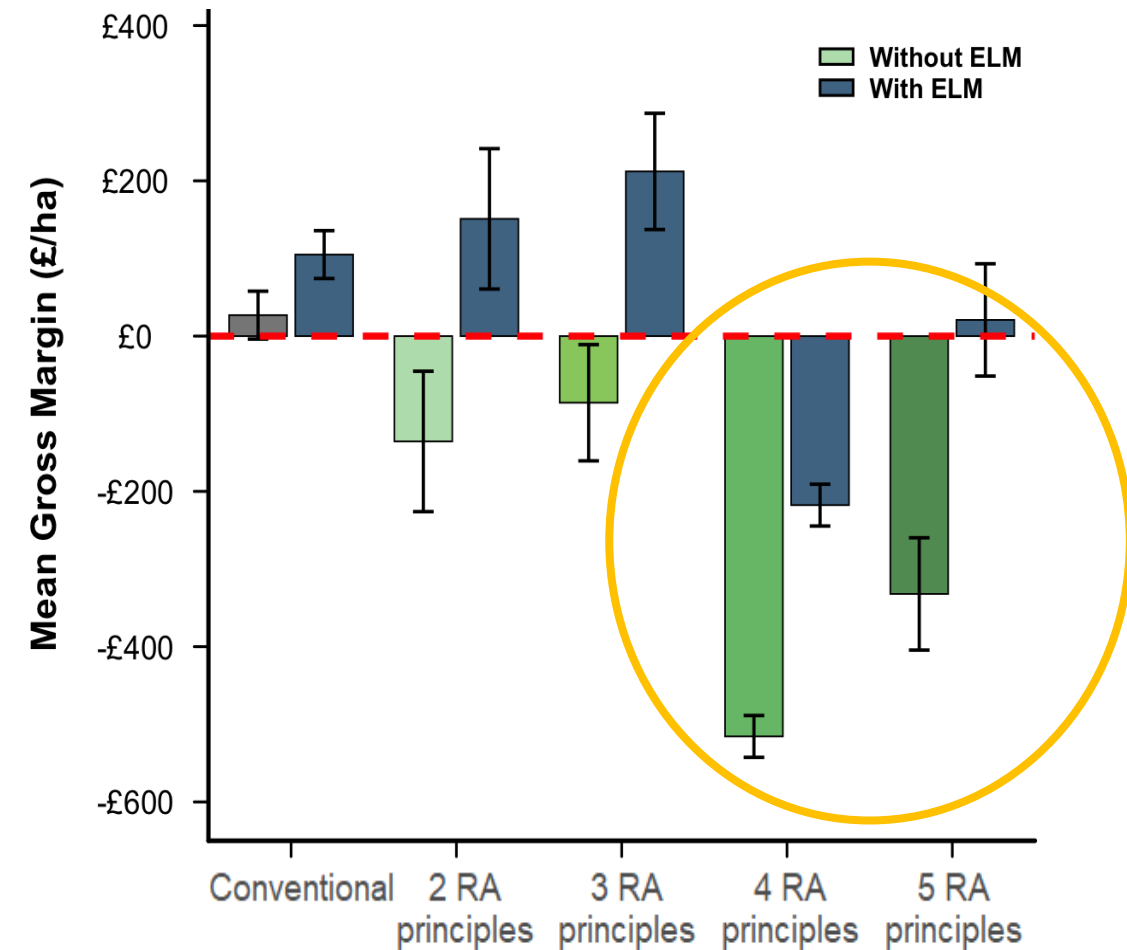


Farm Economics: Gross Margin

2022-2023: Winter Wheat



2024: Spring Barley



Summary

- Yield in year one same across trial
- Yield in years 2 and 3 impacted by climate
- Spring crops challenging to establish in wet and drought conditions
- SFI can help de-risk the transition period
- Long-term data on economics needed



Insights

- Regenerative outcomes **context** dependent (soil type, climate, farmer decisions)
- **Co-design with farmers** increases relevance and adoption potential. Demonstration site (FixOurFood) foster farmer learning, while multi-farm networks (H3) embed local expertise
- Both projects measured **environmental and economic outcomes simultaneously**, highlighting trade-offs (e.g. early yield dips vs. long-term soil health gains)

Challenges

- Short-term funding vs. long-term transitions (10+ years needed for many outcomes)
- Difficulty generalising from single sites
- **Metrics and scoring systems** needed to benchmark regenerative progress
- Policy and industry engagement are essential to scale adoption

