Are regenerative farming practices changing weed diversity / flora?

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ROTHAMSTED RESEARCH

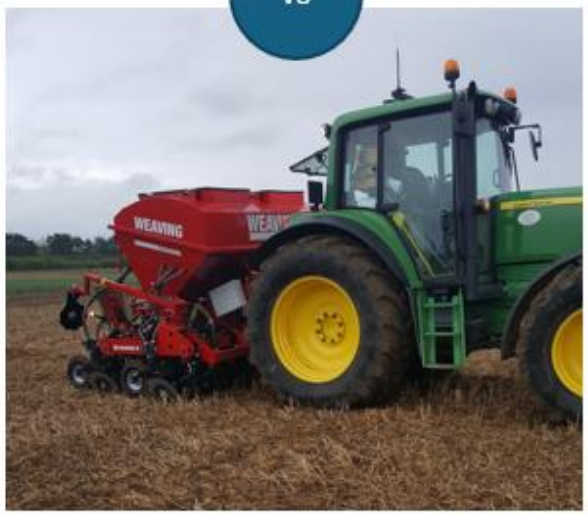
If we were to start a new Long Term Experiment at Rothamsted, what would it look like?

Broadbalk	New Experiment
Focussed on crop nutrition	Multidisciplinary
Lacking robust statistical design	Incorporates statistical power
Focussed on one or two factors	Contrast systems (multi-factorial)
Single site	Multi-site (Brooms Barn, Harpenden)
Long, thin plots	Large, regular plots
Historical legacy	Addressing contemporary questions

Three main treatments:



VS



Annual plough vs. Zero till



Winter wheat



Oilseed rape

2 Crops



Field beans



Spring barley

4 Crops



Sugar beet



Grass / clover

6 Crops

Three contrasting rotations



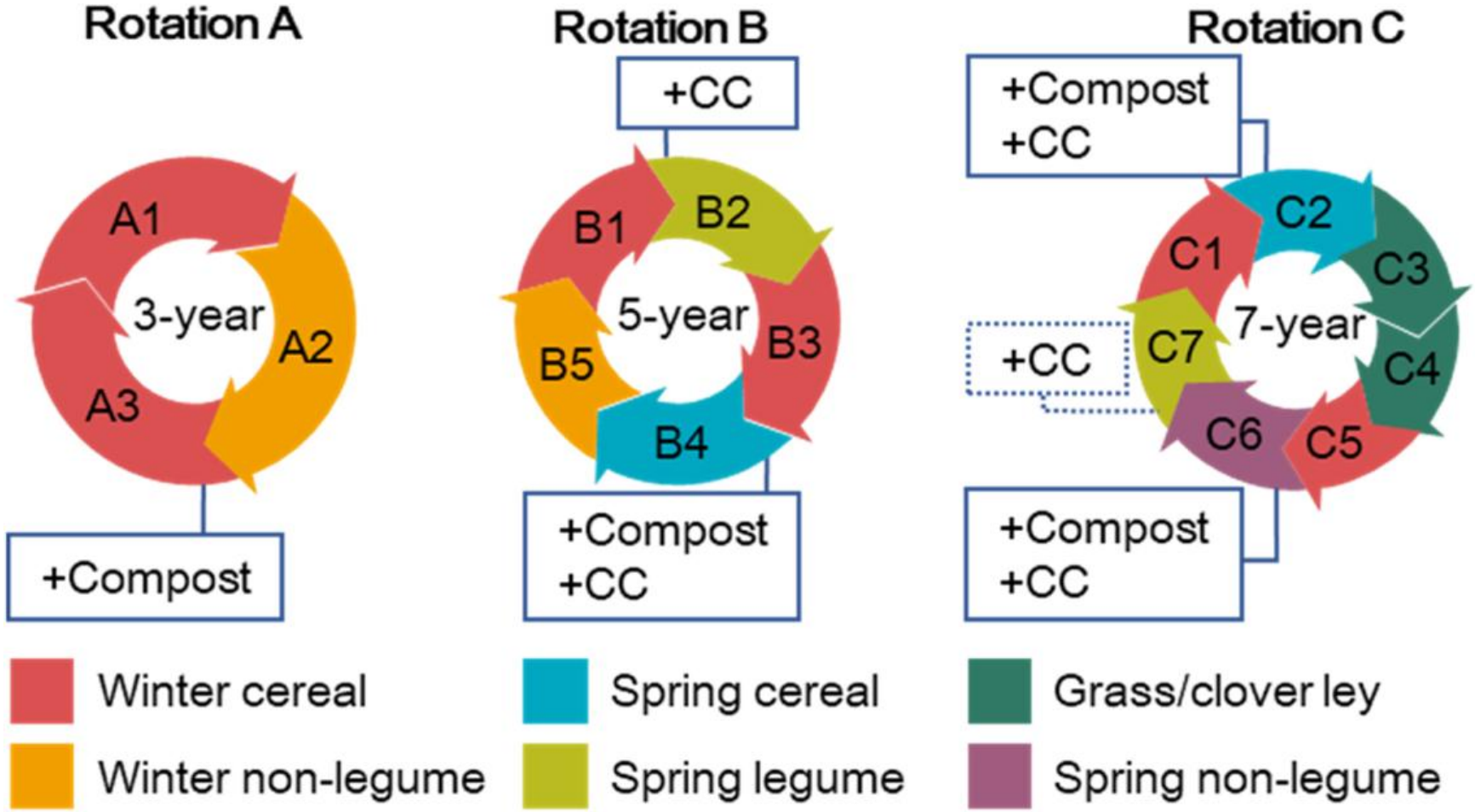
VS



Plus / minus compost

ROTHAMSTED RESEARCH

Three rotations, each phase present every year in each cultivation regime



ROTHAMSTED RESEARCH

Located at Brooms barn (2017) and Harpenden (2018)

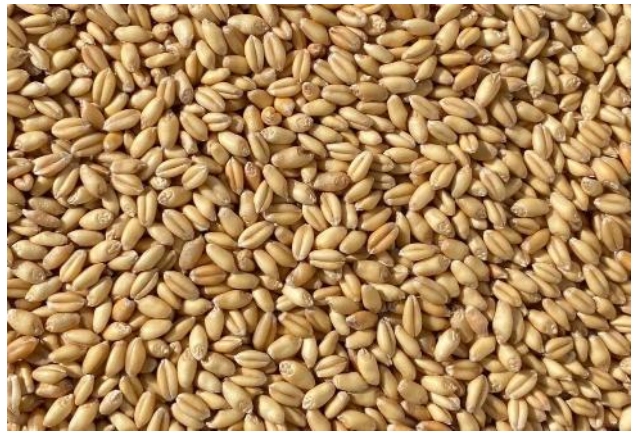




LSRE measurements

- Productivity (yield quantity / quality)
- Biodiversity (ecological surveys)
- Soil health and function (nutrient content, physical structure, microbiome)
- NUE
- Losses to environment
- Pest & disease pressure (OCH project)
- Profitability





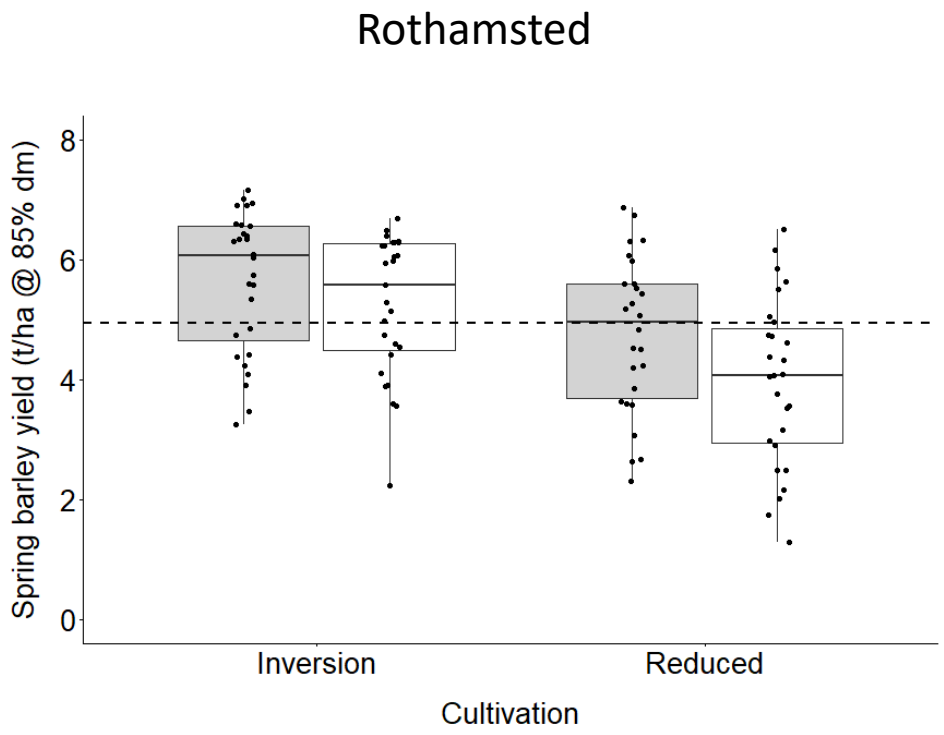






ROTHAMSTED RESEARCH

Spring barley yields by tillage





Spring barley yields with / without compost

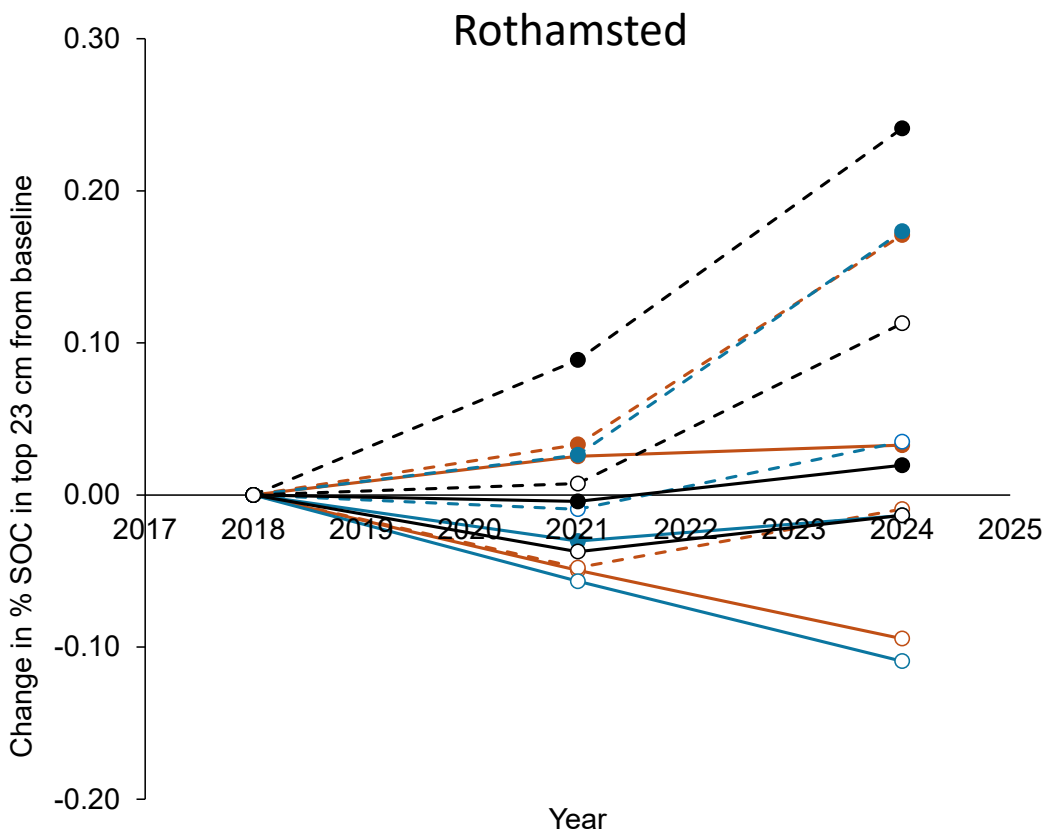
Rothamsted

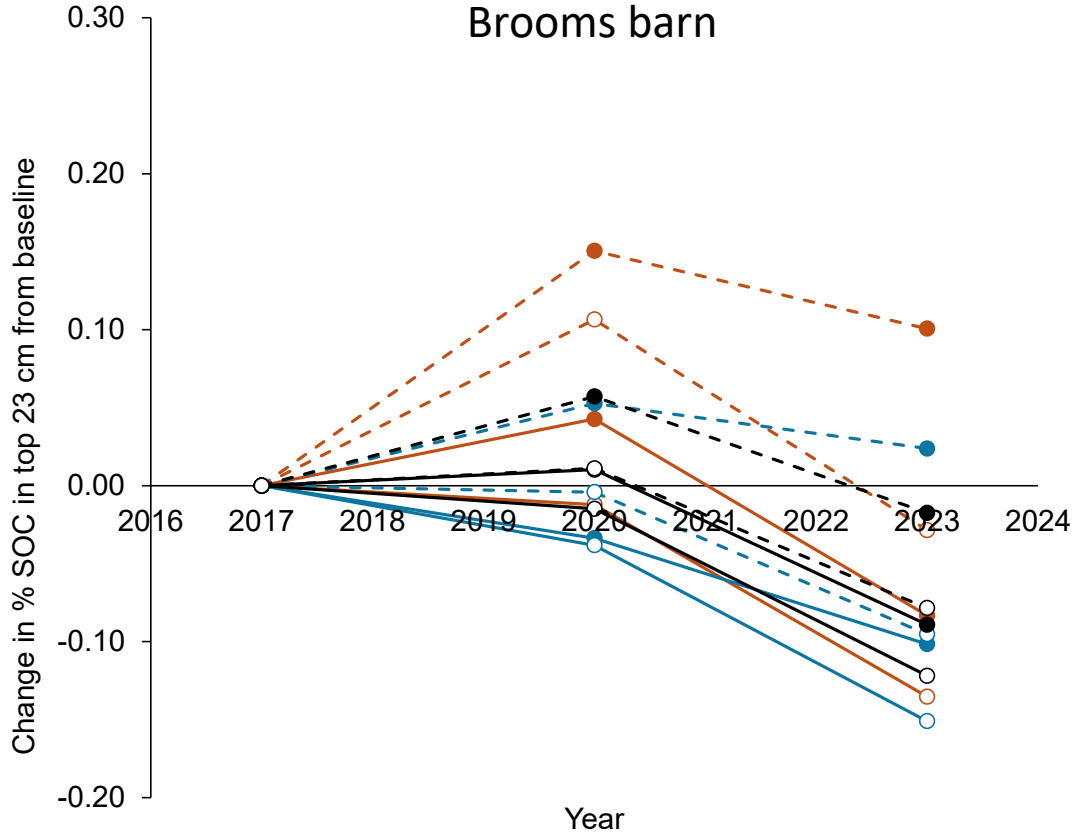
Year	+ compost	- compost	Effect (%)
2022	3.78	3.64	3.85
2023	1.29	1.26	2.38
2024	4.41	5.02	-12.15
2025	5.75	5.63	2.13
2026	5.11	3.91	30.69

Brooms barn

Year	+ compost	- compost	Effect (%)
2022	3.75	2.59	44.79
2023	4.17	3.45	20.87
2024	5.24	4.6	13.91
2025	5.26	4.68	12.39
2026	3.09	3.15	-1.90

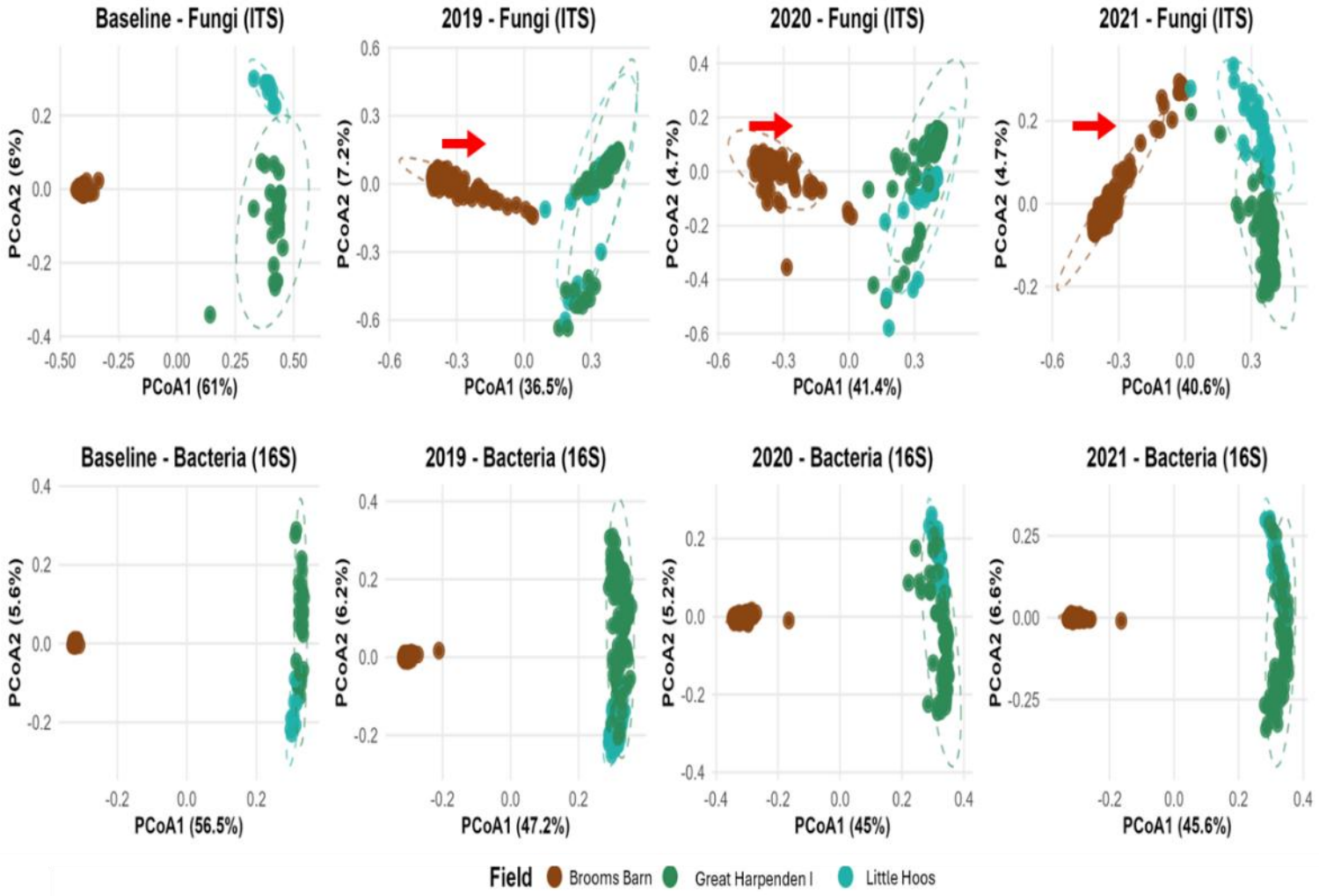
% change in soil organic carbon





ROTHAMSTED RESEARCH

Changes in bacterial and fungal populations

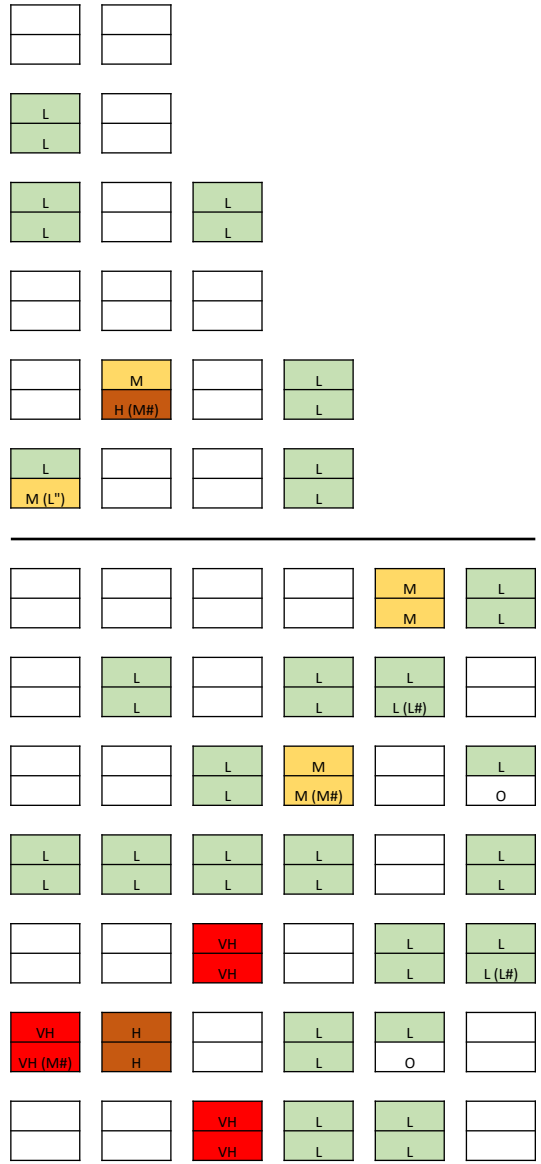


ROTHAMSTED RESEARCH

Visual weed assessment

- Both sites
- Every sub plot
- Winter wheat and spring barley plots only in July
- Density of every weed scored that is visible above the crop canopy (using BGRI ranking system)
- Collected every year for black-grass at Rothamsted since 2018 since 2019 recorded every specie visible
- Started in 2026 for Brooms Barn





Seedbank plant count data

Weed seedbank assessments:

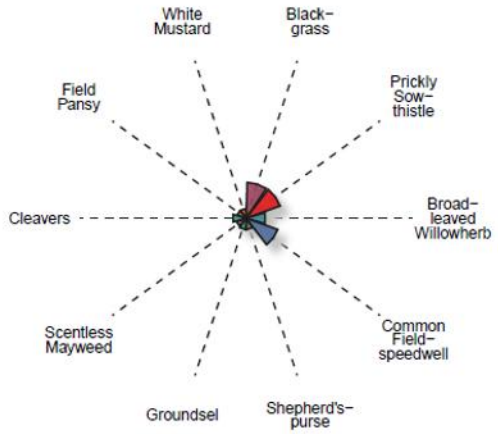
- Both sites
- Every sub plot sampled, between harvest and drilling
- Baseline measurements taken then assessed every 3rd year
- Once in the glasshouse, every seedlings identified, counted and removed





Seedbank data (Rothamsted 6 years)

Inversion 3



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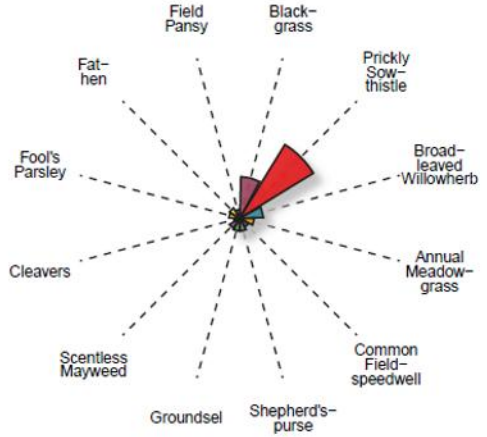

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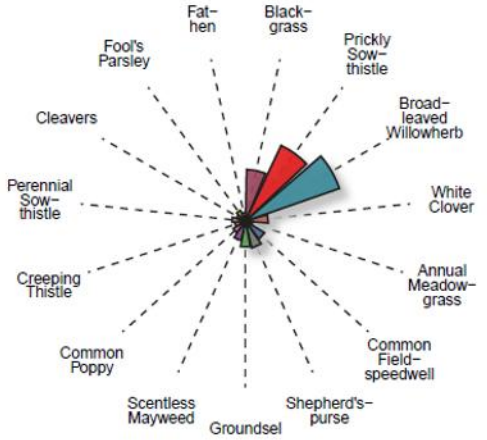

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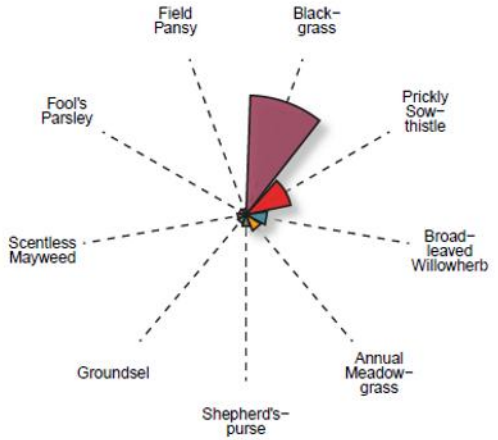

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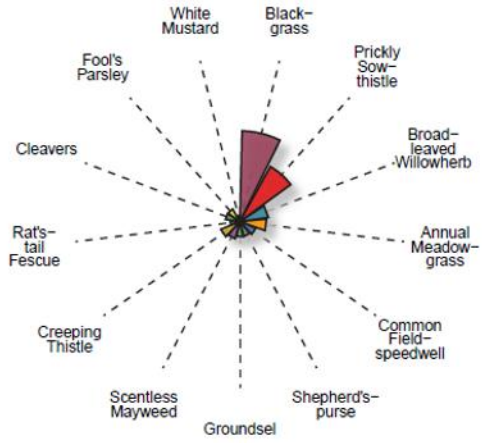

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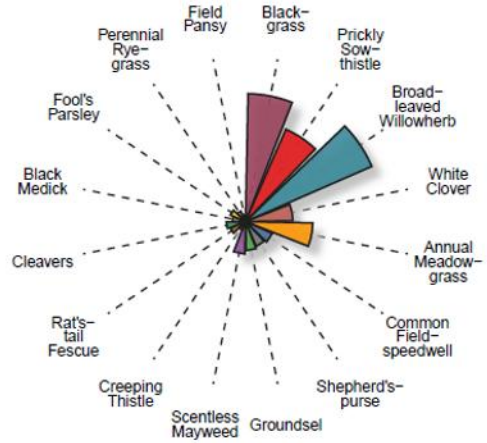
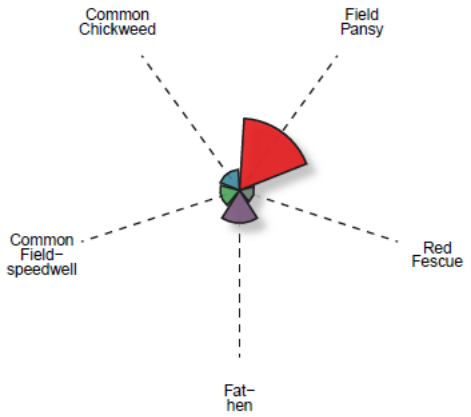


Seedbank data (Brooms Barn 6 years)

Inversion
3



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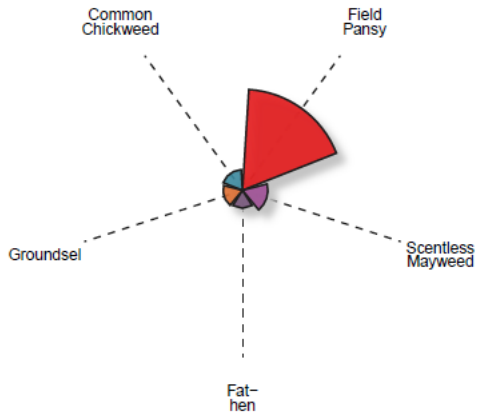

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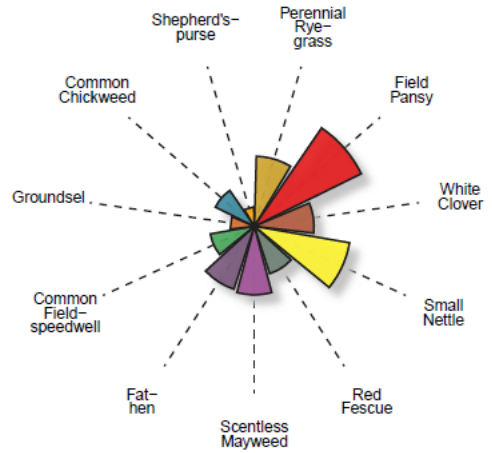

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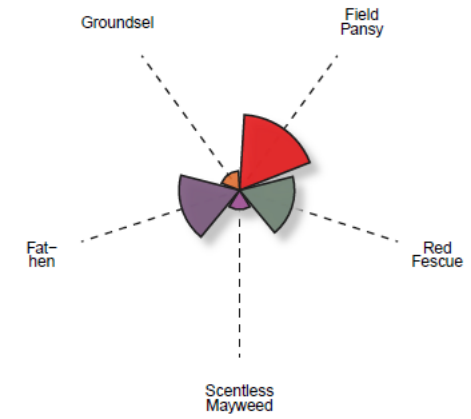

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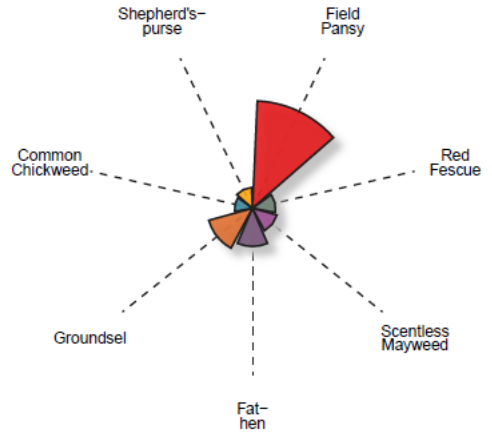

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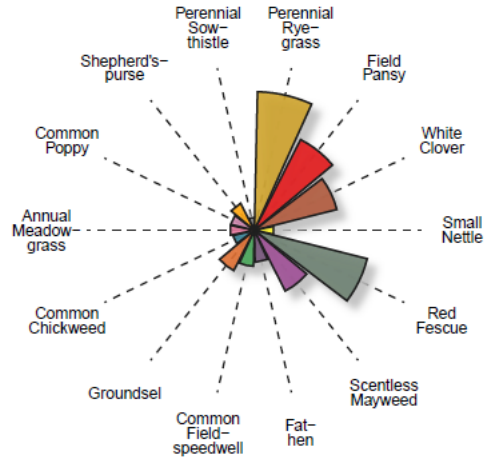
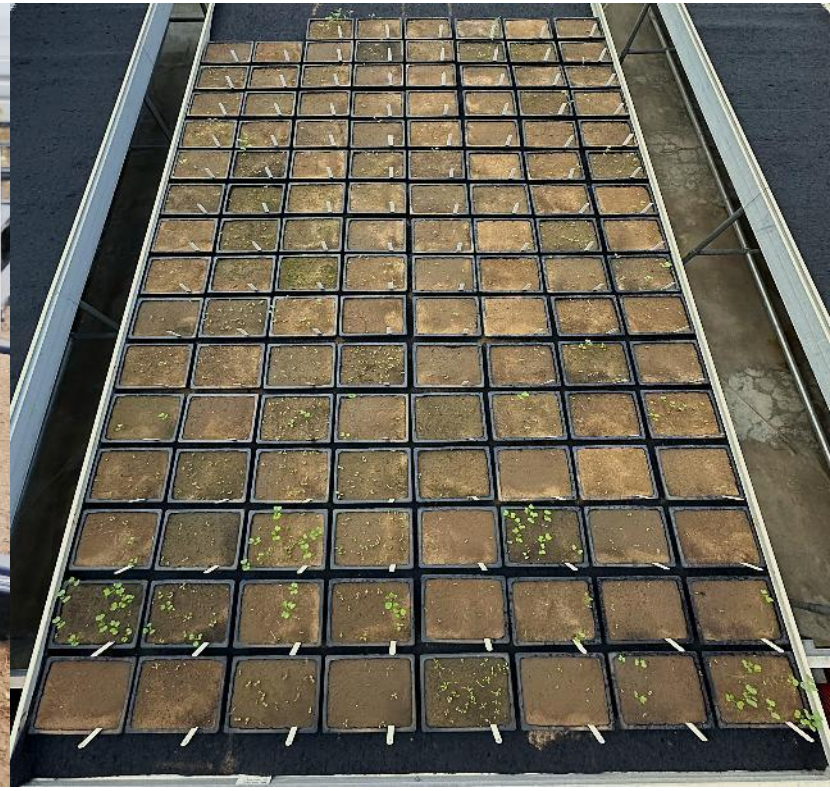
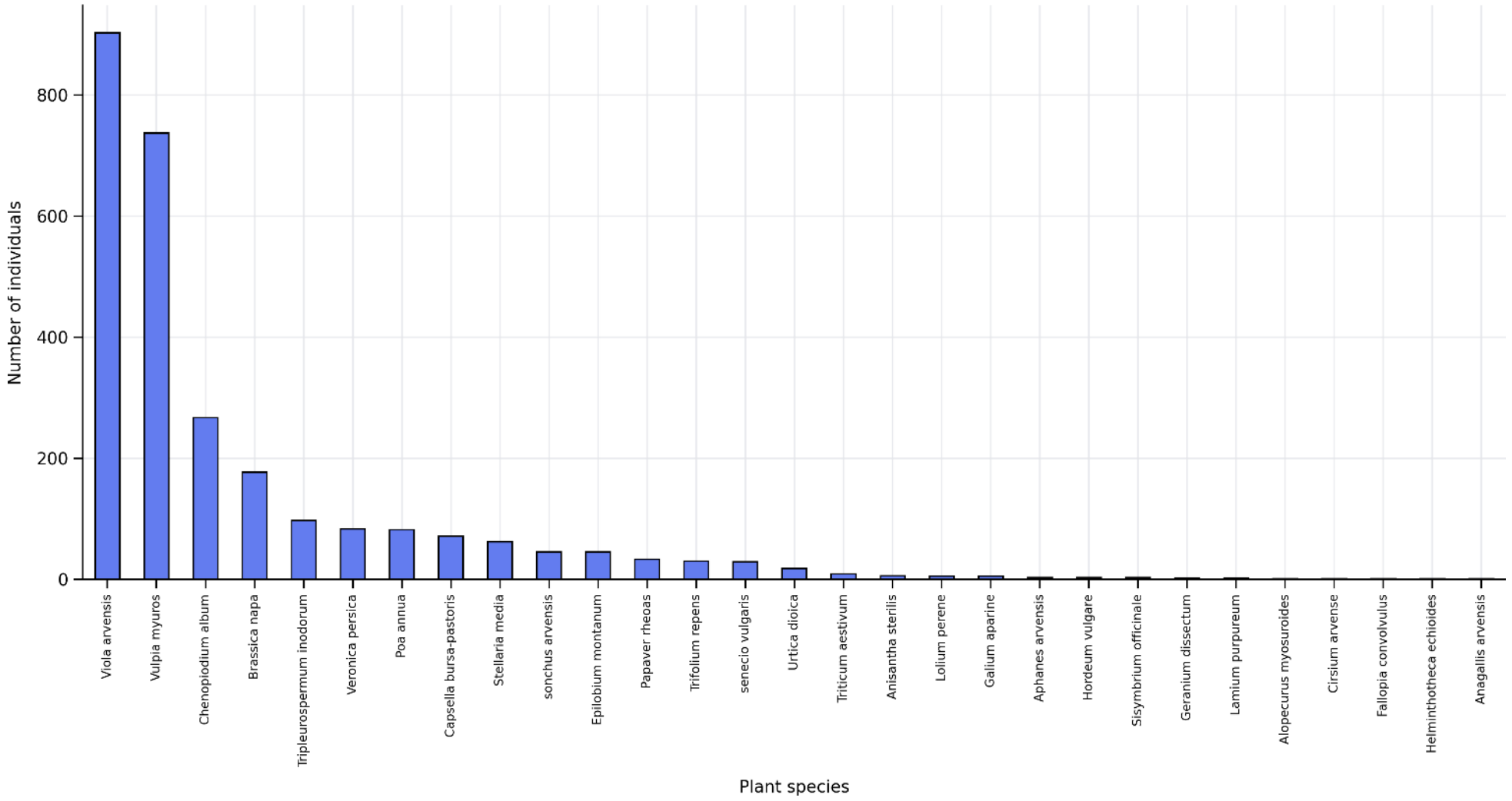


Seedbank data (Brooms barn 9 years)





Seedbank data (Brooms barn 9 years)



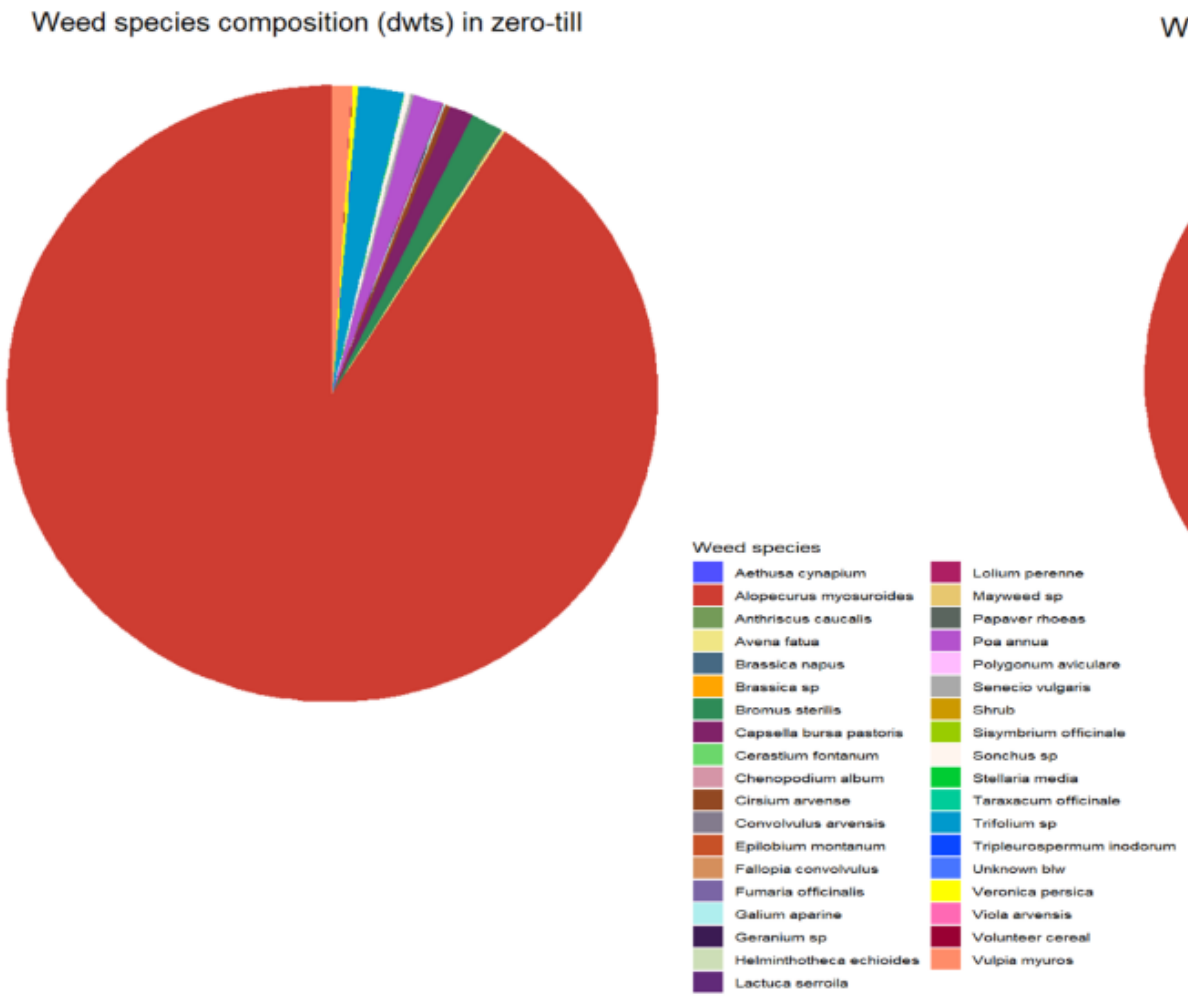
Un-sprayed / sprayed WW quadrats (Brooms Yr9)



Un-sprayed / sprayed WW quadrats (Brooms Yr9)

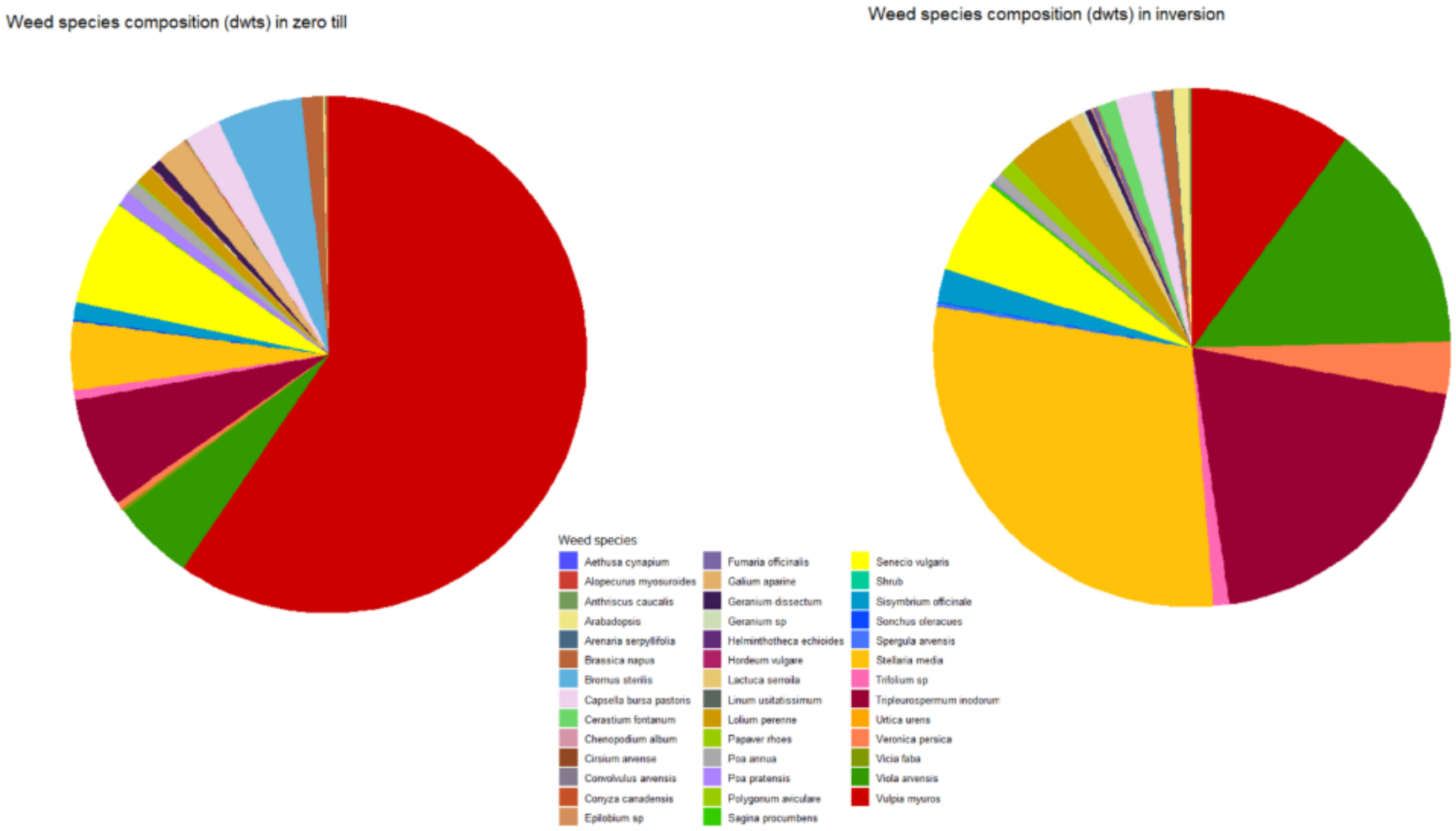


Proportion of weed species by biomass (Rothamsted 8 yrs, 38 species)



ROTHAMSTED RESEARCH

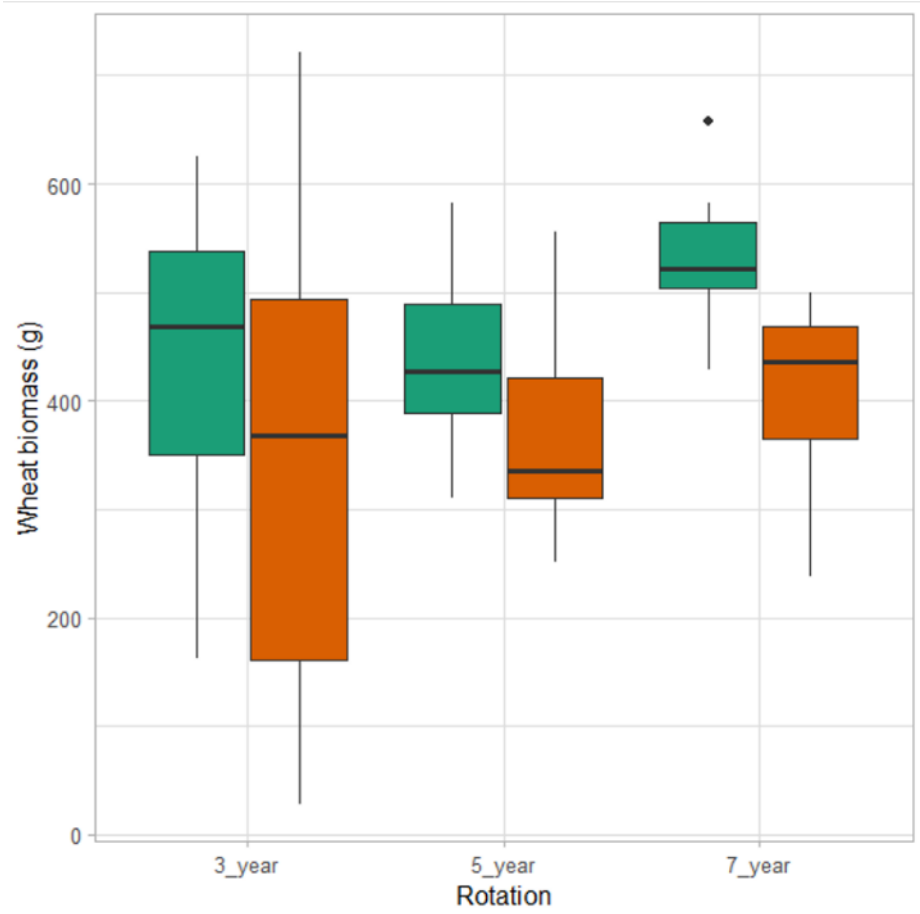
Proportion of weed species by biomass (Brooms 9 yrs, 41 species)



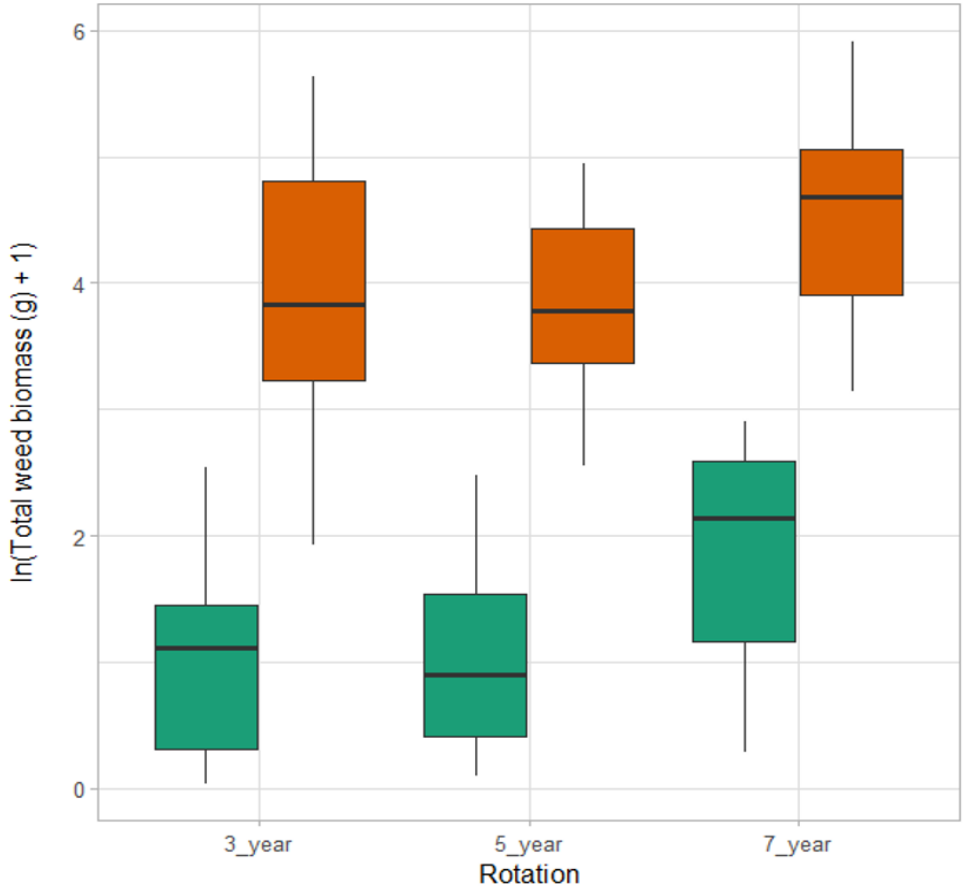
ROTHAMSTED RESEARCH

Wheat and weed biomass (Brooms Yr9)

Wheat biomass in rotation treatments (sprayed vs unsprayed)

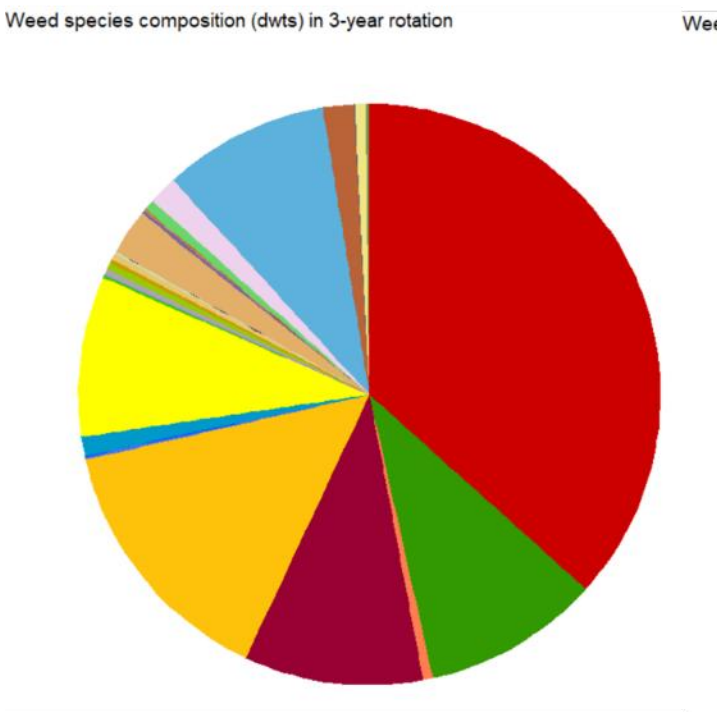


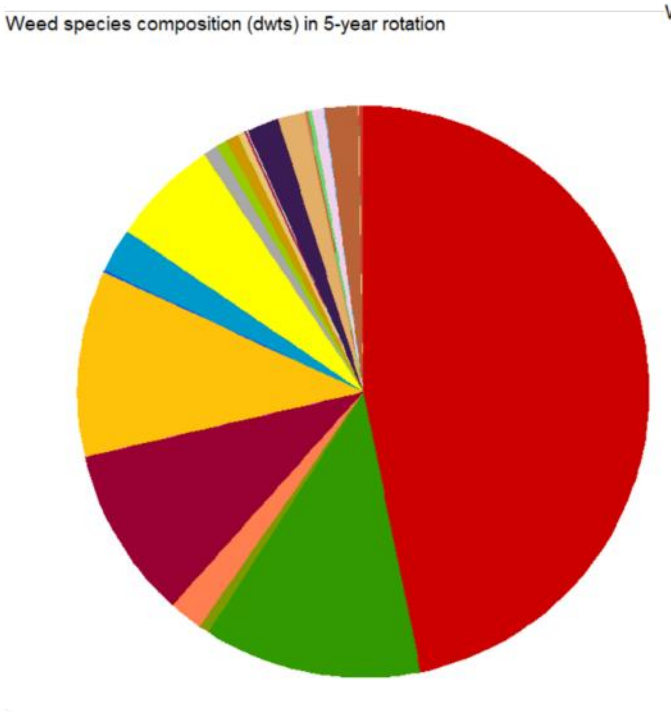
Total weed biomass in rotation treatments (sprayed vs unsprayed)

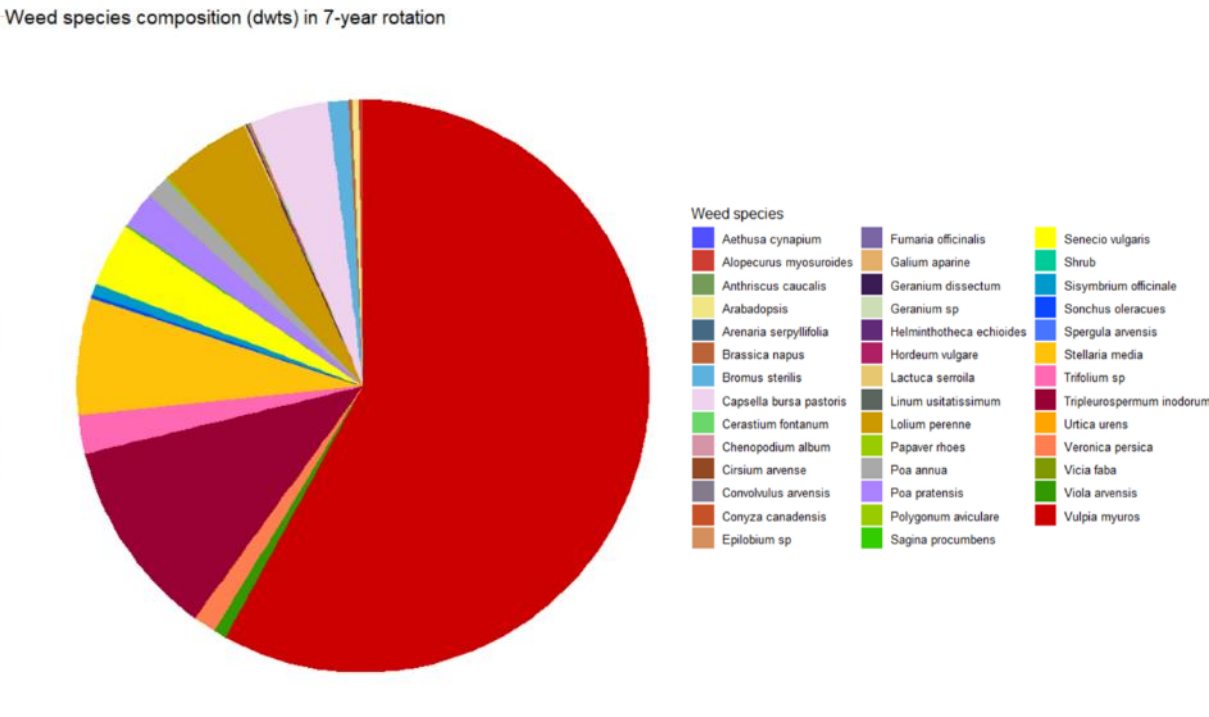


ROTHAMSTED RESEARCH

Proportion of species by rotation (Brooms Yr9)







ROTHAMSTED RESEARCH

Final remarks

- Long term funding vital, outcomes change over varying time periods
- Can sequester carbon at Rothamsted on no-till plots (but very slow)
- Changes in fungal populations only at Brooms
- Weed population at Rothamsted still dominated by black-grass
- Species composition at Brooms changing with tillage and rotation
- Room for experimentation and collaboration