ROTHAMSTED RESEARCH

CAPABILITY CONNECTIVITY CULTURE

Agronomy for soils, crops and human health and climate resilient food systems

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What was the need?

To create sustainable agriculture that meets the needs of the current generation without compromising the environment for future generations. Sustainable agriculture has three principles which are interlinked, the social principle, meaning it should be socially equitable to everyone and also environmentally sustainable and economically profitable.

However, European farming systems are highly mechanised, and they also have high nutrients inputs in terms of external fertiliser application, and they are less diversified because they focus more on cereal production. While high fertiliser input is good for improved crop productivity, this often leads to environmental degradation. On the other hand, African small holder farming systems are more diversified in the sense that you have more cereal and grain legume production. However, there are low external fertiliser inputs and soils are highly degraded, resulting in poor crop productivity and of often low nutritional value. To add on to this challenge, there are also elevated carbon dioxide concentrations, which are projected to result in a decline in grain zinc concentration of C3 crops of around 9% and also a decline in iron of around 5%, meaning our foods are going to be less nutritious. Around 62% of children under the age of five years are at risk of micronutrient deficiency. Equally around 80% of non-pregnant women are also at risk of micronutrient deficiency, such as ion, iodine, essential vitamins and selenium.

What did we do?

RRes was commissioned by Unilever to conduct an extensive literature review to look at the contribution of regenerative agriculture to increase crop nutrition. Unilever was interested in effect of different regenerative agriculture practices on nutritional quality of edible parts of crops including rice, wheat, tomatoes, maize and pulses.

We started by looking at 3000 papers published between 2000 and 2021. We screened them down to 350 publications, which we've reviewed. The regenerative agriculture practises of interest were use of organic inputs, reduced tillage, deficit irrigation, use of bio stimulants and intercropping. This was an extensive global literature review.

What did we achieve?

There was good evidence that some regenerative practices such as organic inputs improved grain zinc concentration in rice and in tomatoes. However, there is significant research gaps in most crops indicating a need for further research.

I was then interested in looking and following up some of the farmer platforms which we are working with under the Growing Health Institute Strategic Programme. I targeted the Wild Farmed growers network. This is a network of farmers who are implementing regenerative agriculture, specifically low nutrient input, and they also implement production of companion crops such as legumes.

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FarmED has an 8-year cereal herbal lay crop rotation system which I was also interested in. They also have sheep grazing in the herbal lay system and also a control conventional crop plot where they apply low nutrients inputs.

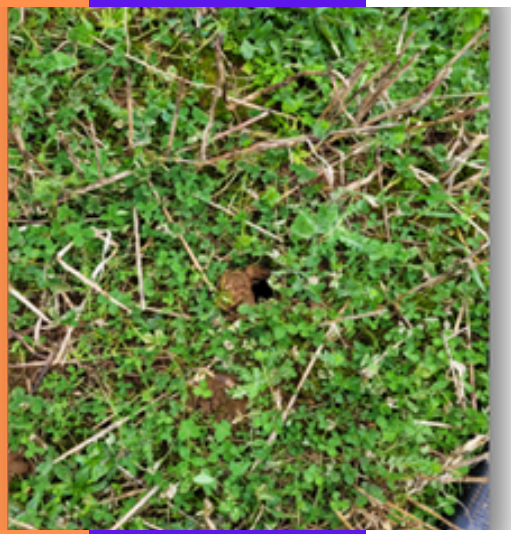
I had five farms which were distributed across 11 fields. Nine of these were under regenerative agriculture and two were control fields.

We collected soil samples for chemical analysis and also for bulk density in January to February (2024).

The regenerative agricultural practises spanned across no tillage, reduced tillage, the use of cover cropping, intercropping and sheep grazing. The soil results showed no significant differences in micronutrient concentration between the regenerative agriculture fields and the control fields, but we did see a significant effect of regenerative agriculture on grain zinc concentration in wheat and also grain iron concentration with the regenerative agriculture fields producing more nutritious grains than the control fields.

WHAT ELSE WILL WE DO TO INCREASE OUTCOMES?

Further work will include targeting more farms implementing regenerative agriculture and analysing a wealth of data sets at Rothamsted's Research farm platforms to look at effect of different management practices on grain nutrition of crops grown under sufficiently powered field trials and over a long period of time.



How are we going to monitor the outcomes?

We will monitor outcomes by analysing the data to model impacts of changes in cropping systems on nutrition of wider UK population. For example, if all wheat produced in the UK is farmed in a regenerative agricultural approach, what will this imply in terms of increasing the nutrition of the wider UK animal and human health nutrition