THE MORLEY
AGRICULTURAL FOUNDATION
&
MORLEY FARMS LIMITED

2023

The Morley Agricultural Foundation and Morley Farms and Trials

Summary of our Activities

Summary of our Activities 2023

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The Morley Agricultural Foundation

The Morley Agricultural Foundation (TMAF) is a charity which hosts and facilitates scientific agricultural research, education, and training. Promoting the application of effective husbandry techniques, the aim is for high-yielding and profitable agriculture with minimal negative effects on the wider environment & ecosystems.

We achieve this through the use of our own land and commercial farm business for trials and research projects, and as a charity by making grants to organisations and individuals.

We are proud to be working with NIAB, BBRO (British Beet Research Organisation) and JIC (John Innes Centre), along with a range of other charities and trusted commercial organisations.

Research on the farm continues to focus on soil management and improvement, and increasingly on clean water and air. Our own Soil and Agronomic Monitoring Study (SAMS) is looking in detail at how farming practices affect the soil over the longer term, and the NIAB New Farming Systems project continues its valuable work on rotations and soil amendments. Both projects benefit from Morley being able to facilitate long-term research sites.

As well as continuing with the traditional areas of study we will be increasingly involved with precision management; through the understanding and use of data, remote sensing, Artificial Intelligence and machine learning, and by supporting the adoption of these technologies on-farm.

The TMAF fully funded PhDs are underway, and we are playing an active part in the Collaborative Training Partnership for Sustainable Agricultural Innovation (CTP-SAI) programme.

To find and support studies in our areas of interest we have engaged with the Agricultural Food Charities Partnership (AFCP) and have been supporting the early development of the Agricultural Universities Council (AUC). We aim for a balanced mix of research which has the most relevance to practical agriculture.

TMAF values independent thinking and research, and we do seek collaboration with like-minded partners.

We are an open organisation, welcoming involvement, information dissemination and exchange at all levels, we encourage the use of the farm and facilities to enable the communication of ideas, including with the wider public.

UK agriculture is a dynamic and demanding sector, the agriculturalists that prosper in the future will have to be well-informed, trained, and resourced. It is important that TMAF supports the personal and career development of those who can turn research into a practical reality. We will continue to find ways of bringing scientific research and effective techniques to the farm, helping to maintain and improve knowledge and skills across the industry.

Morley Farms Ltd

Morley Farms Ltd. is the commercial farming arm of The Morley Agricultural Foundation. The company farms over 750 ha (1,800 ac) of which 714 ha is currently cropped with the remainder being permanent pasture, woodland, and tracks. The land farmed is on several holdings with the furthest being 10 miles away.

Summary of land cropped by Morley Farms

Farm	Tenure	Ha
Manor Farm, Morley	Rented from TMAF	527
Church Farm, Bawburgh	Rented from John Innes Centre	147
Land	Contract farmed locally	40
Total		**714**

Crops grown include winter wheat, winter malting barley, sugar beet, spring malting barley, oats, forage maize, rye, and vining peas. The soil on the farm varies from field to field but will support the crops mentioned above. The soil is typically classified grade 2 or 3 and ranges from 'Ashley series' light - sandy loam to 'Beccles series' medium - sandy clay loam. With careful planning the soil supports sugar beet well, achieving good yields and giving flexibility to be lifted throughout the campaign.

Crop	Typical yields (t/ha)
Winter wheat	10
Winter barley	7
Spring barley	6.5
Spring wheat	6
Sugar beet	82
Winter oats	7.5
Forage maize	37
Rye	7

Morley Farms' link with John Innes Centre

The land farmed at Church Farm, Bawburgh is owned by the John Innes Centre and let to Morley Farms on a farm business tenancy (FBT). This farm has a wide range of soil types often in the same field. JIC carryout their outdoor trials program on the more consistent land. The trials are mostly wheat and cover about 8 - 10 ha. JIC require 1st wheat trials every 3 years, and a rotation is chosen to fit in to the trials programme.

Cropping rotation

The rotation is not fixed but changes slightly to accommodate trials etc., where possible fields are blocked together. The areas of each crop are matched to the storage facilities. Each year it is important to have a balance of crop areas to spread risks and workloads.

Barley and wheat straw is baled to go to three local farms. Pig and cattle manure returns to the farm.

Crop storage

Manor Farm has various grain stores, which include 3,600 t of capacity on floor drying buildings. There is a further 500 t capacity of on floor storage. The recent investment in grain storage has helped to future proof the farm by having grain storage that will meet future grain storage food safety requirements and gives the farm more flexibility in marketing.

Markets

- Sugar Beet is grown on contract to British Sugar. Morley Farms has a contract for 7,500 t. Manor Farm, Morley is 25 miles from the Cantley sugar factory.
- Wheat is grown for feed and sold through merchants to local markets for livestock rations for chickens, turkeys, and pigs. An alternative market is export as we are not far from a seaport; each year a percentage of the crop is exported.
- Winter and spring barley are grown to produce malting quality barley that is sold through merchants to local maltsters who supply the brewing and distilling industry.
- Oats are targeted at the human consumption market to make porridge oats and cereal bars.
- Forage maize is grown to supply local anaerobic digesters that produce electricity.

Use of the farm for trials and knowledge exchange

The farm hosts field trials for NIAB, The John Innes Centre (JIC) and British Beet Research Organisation (BBRO). These organisations manage over 7,000 plots. Typically, the plots (2 m x 12 m) are within a field of the same crop. The area occupied by research is about 20 ha and is distributed around the farm in smaller lots.

The farm hosts a BBRO demonstration site which includes a collection of closely monitored demonstration plots. The site is available for the industry to visit by invitation of BBRO. Visitors include growers, British Sugar staff, agronomists, students.

From time to time our farm has been used by other organisation for trials and monitoring including Association of Independent Crop Consultants (AICC) and Agrovista.

New Heritage Barley Ltd

New Heritage Barley is a science-focussed company that revives old barley varieties both for their own merit and as a source of genetic diversity for the creation of new varieties for the craft brewing industry. The company is a start-up from research originating at the John Innes Centre (JIC) which originally focused on disease resistance in barley landraces, but then investigated the potential for heritage barleys in craft brewing. The Genomics Resources Unit at JIC comprises landraces and early cultivars and is the source of seed with known provenance. One of the varieties that was of interest was Chevallier, first selected in the early 1800s. This variety was found to have very good resistance to fusarium head blight and was also the dominant malting barley in England for nearly 100 years, making it an obvious first choice for re-commercialisation.

Since 2013 Morley Farms has been growing a crop of Chevallier barley for seed. This started as 0.5 ha producing 1,500 kg to growing 7 ha producing approximately 25 tonnes. The seed is sold to others locally to produce a malt crop. In recent years, two further varieties Plumage Archer and Hanna have been grown for seed.

Staff

There are 3 full time staff: a working manager and 2 machine operators. This is supplemented by ad hoc casual staff at harvest. Straw baling and sugar beet harvesting is done by local contractors.

Machinery

Machine	Size	Age
Combine Lexion 7500	9 m header	2021
John Deere 7310	300 hp	2016
New Holland T7225	175 hp	2017
New Holland T7270	240 hp	2020
Bateman RB26 sprayer	24 m	2015
JCB loader 531		2016

Implements	Manufacturer	Detail
Drill	Horsch	6 m pronto
Drill	Accord	4 m tine coulters
Drill	Boom bio drill	6 m broadcast seed
Drill	Monosem	12 row beet drill with tramlines
Plough	Kvernland	6 furrow variable width
Primary cultivator	Sumo trio	3 m includes OSR drill kit
Primary cultivator	Vaderstad Opus	4 m
Cultivator	Vaderstad NZA	6 m spring tine
Cultivator	Kvernland TLG	5 m spring tine for sugar beet
Cultivator	Simba Cultipress	5.5 m tine and press
Cultivator	Simba xpress	6.6 m disc and press
Cultivator	Maschio	4 m Power harrow
Subsoiler	Simba	3 leg
Trailers tipping	1 × Warwick, 2 × Bailey	14 t, 18 t fitted with floatation tyres
Trailer flatbed	AS Marsden	14 t
Water bowser		10,000 litres
Roller	Twose	7.5 m Cambridge roll
Topper	Shelbourne Reynolds	3 m
Hedge cutter	Shelbourne Reynolds	7 m with 1.5 m head
Digger	Case	5 t 360°

Burfield Hall Farm

The Morley Agricultural Foundation has a small number of let properties within its portfolio. This includes four local residential properties and 28,000 square feet of commercial storage. Most of the commercial storage is at Burfield Hall Farm near Wymondham which makes use of farm buildings no longer suited to modern agriculture.

Our Commitment to the Countryside

For over 30 years we have been creating features and habitats to enhance the wildlife diversity of what would otherwise be a reasonably bland arable farm.

This has been supported by the Countryside Stewardship and High Level Scheme initiatives from the government. The work has included:

- Managing hedges to provide shelter and food sources for birds.
- Creating grass and flower-enriched margins around fields to connect the landscape, but also to act as buffer zones adjacent to water.
- Create pollen and nectar sources by growing seed crops for wild birds annually.
- Maintain permanent grassland using virtually no fertiliser or pesticides.

Sustainable Farming Incentive pilot

We have been accepted for a 3-year pilot of the Sustainable Farming Incentive Pilot starting in March 2022. This will continue with the aims mentioned above.

Summary of standards chosen:

- Arable soils standard – Advanced
- Waterbody buffering standard – Advanced
- Hedgerows standard – Introductory
- Low and no input grass – Advanced
- Arable land – intermediate

The main change from the past is the introduction of the soil standard which aims to be a journey of soil improvement through better measuring, increasing soil organic matter and more efficient nutrient use.

As a pilot, it gives us the opportunity to feedback to DEFRA on how the scheme works and how it could be improved for the benefit of the landscape and administration.

The Morley PhD Studentship Programme Funded by TMAF

THE MORLEY AGRICULTURAL FOUNDATION

TMAF has continued to build on its fully funded Morley PhD Studentship Programme since it started in 2019. We are currently recruiting for the Autumn 2023 intake having successfully started with two PhD students in October 2022. These PhD studentships were selected from proposals submitted to the TMAF Board through links forged with the University of Cambridge and NIAB. The latest Morley PhD Studentship has supervisors at the University of East Anglia, The Quadram Institute and John Innes Centre reflecting a broadening of TMAF connections to other relevant academic partnerships for delivering our studentship programme.

Collaborative Training Partnership for Sustainable Agricultural Innovation (CTP-SAI)

Find out more about the CTP-SAI at www.ctp-sai.org, or contact TMAF.

TMAF's involvement in promoting its own PhD Studentships led to it being invited to join a bid to the BBSRC for a Collaborative Training Partnership (CTP) led by G's Growers and involving Pepsico, Sainsbury's, Syngenta, Solynta, James Hutton Ltd, PGRO, TMAF, and CUPGRA. Lead academic partners are NIAB, University of Cambridge, CSC, and James Sutton Institute with eight other Universities as associated partners. The bid to BBSRC was successful and the Sustainable Agricultural Innovation CTP was awarded funding for 30 PhD studentships to work in an academic/industrial environment. TMAF supported several studentship proposals in the first tranche of 10 that were allocated and secured two of them. Two TMAF-aligned CTP PhD students started in October 2022 with supervisors at the Universities of Nottingham and Cambridge, and NIAB, and a third is under recruitment for the Autumn 2023 intake involving NIAB, Harper Adams University, and the James Hutton Institute.

The launch of the Crop Science Centre (CSC) in 2020, a joint venture by the University of Cambridge and NIAB on the new NIAB campus, has created new research opportunities and a PhD Studentship, with a learning and development experience aligned to the CTP, has been awarded to joint supervisors from both of these organisations in conjunction with other Agrifood Charities Partnership (AFCP) charities.

The students appointed to these will be the start of a TMAF cohort that will interact with each other and the TMAF Board, including spending time at Morley to get first-hand experience of agriculture and innovation. They will also interact with the University/CTP cohorts through their training programmes.

Elina Bidash

Manipulating meiotic recombination for crop breading

My interest in plant sciences developed during my undergraduate degree in Natural Sciences at the University of Cambridge. Specifically, I wanted to focus on research which explores how the knowledge of fundamental plant biology can be translated to tackle real-life problems. This is what attracted me to my PhD project which aims to manipulate the process known as meiotic recombination which creates genetic diversity necessary for breeding new crop varieties. The goal is to transiently increase recombination and accelerate the generation of desirable trait combinations using soybean as a legume model. To achieve this, I will explore transgenic and transgene-free approaches using virus-based technologies for genome editing and altering the expression of genes which are known to control recombination. The hope is to create a foundation for future (pre)breeding programmes to develop soybean varieties adapted to the UK climate, with the scope to extend this work to other legumes of interest as well as non-leguminous crops.

Anisa Blower

Exploration of NIAB's synthetic wheat as a new source of disease resistance for effective genetic control of *Septoria tritici*

Anisa has recently completed her integrated Masters in Biological Sciences at the University of Warwick with a research background in ancient antimicrobials. She is excited to explore her microbiological interests in the context of plant pathology and is keen to pursue a research topic which will positively impact the future sustainability of UK agriculture. During her PhD, Anisa will explore resistance to Septoria tritici blotch (STB), a globally important and yield-limiting wheat disease, in a number of synthetic wheat (SW) lines. These SW lines have been created by crossing a Durum wheat with wild goat grasses, mimicking a historical natural hybridisation which gave rise to bread wheat as we know it. The ability to capture and integrate wild diversity into a modern wheat background, via the creation of SWs, provides new avenues in the exploration of novel and durable genetic resistances. Initially, Anisa is testing over 60 lines for UK field STB resistance, the results of which will guide her subsequent investigation of larger populations. She hopes that, by exploring this new resource and understanding fundamental aspects of STB resistance, this project will provide breeders with powerful genetic tools to produce the next generation of STB-resistant wheat varieties, requiring lower fungicide application.

Abi Brock

Improving nitrogen use efficiency in cereal crops for sustainable food production

Abi graduated with a BSc Hons in Natural Sciences from Durham University and an MSc in Green Life Sciences from the University of Amsterdam, before spending two years working in the industry for Syngenta. In her PhD, Abi will study nutrient use efficiency in rice, wheat, and barley, in the hope of developing crops that require less fertiliser while keeping yields high. Achieving this would mean reducing costs to farmers whilst also limiting the environmental implications of high fertiliser use. She hopes that working with TMAF will help her project not just improve scientific understanding, but also produce outcomes that will be directly useful to farmers.

Anya Heathcote

Increasing climate resiliency and yield stability in wheat through genetic improvement of root systems

Having graduated in 2022 with a BSc Hons in Plant Science from the University of Nottingham, Anya was keen to pursue a farmer-forward research subject in the next stage of her career. Through her PhD, Anya aims to develop a measure of yield stability which may be routinely reported for wheat varieties in the Recommended Lists. Her work will also attempt to uncover the genetic control of root adaptation under water-limiting conditions, such as those frequently experienced in the region, and identify what advantages this may infer to more resilient varieties. Her hope is that this will provide farmers and breeders with the necessary tools to sustain crop yields in the rapidly changing climate, and she is delighted to have the opportunity to interact directly with growers and better understand their needs through TMAF.

Ian Tsang

Supporting future wheat improvement underpinned by novel genetic diversity for root traits

After graduating with an MSci in Biological Sciences from the University of Bristol, Ian has chosen to undertake a PhD in Plant and Crop Sciences at NIAB, Cambridge, to further his academic interests and contribute towards the current understanding of cereal root biology. Specifically, Ian will be investigating how root hair development is regulated in bread wheat. Throughout his PhD, Ian will be using a variety of gene silencing and gene editing techniques to identify a list of genes that are responsible for regulating root hair development. Understanding this regulation will provide plant breeders with valuable knowledge to select for wheat varieties with longer, denser root hairs, which will improve wheat nutrient and water uptake, subsequently translating to increased field performance.

NIAB East (Morley) Trials

The NIAB team, based at Morley Business Centre along with TMAF in the village of Morley, is responsible for an extensive range of crop trials across a wide geographical area - from the north Norfolk coast, across Suffolk, down into Essex and across into south Lincolnshire. The six-strong team runs over 8,500 crop plots, around 2,000 of which are based at Morley Farms.

The trials programme includes combinable winter and spring cereals, sugar beet, veg and maize. Overall, research themes include crop inputs, crop nutrition, pest impact and management, variety evaluation, wider agronomy interaction studies and novel systems.

As well as running its own trials for the NIAB agronomy membership, they also carry out trials for a wide range of commercial customers including breeders, ag-chem and fertiliser manufacturers, AHDB, merchants/distributors, machinery manufacturers and other industry stakeholders.

Crop	Trial Type	Customer
Winter Wheat	Fungicide/Disease	Commercial Customers, NIAB Agronomy Membership & AHDB
	Fertiliser/Nutrient	Commercial Customer & NIAB Agronomy Membership
	Variety	Commercial Customers, NIAB Agronomy Membership, BSPB & AHDB
Winter Barley	Fungicide	NIAB Agronomy Membership
	Variety	Commercial Customers, NIAB Agronomy Membership & AHDB
	Fertiliser	Commercial Customers & NIAB Agronomy Membership
Spring Barley	Variety	Commercial Customers, AHDB & BSPB
	Fertiliser	Commercial Customers
Spring Wheat	Variety	Commercial Customers
Maize	Variety	BSPB
	Contract drilling/harvesting	Commercial Customers
Sugarbeet	Variety	BSPB
	Fertiliser	Commercial Customers
Field Veg	Variety	Onion Growers Association
	Contract Drilling	Commercial Customers

The centre has its own tractor (JD 6115R) with RTK GPS, a bespoke disc drill for plot establishment, a new 12 m tractor mounted sprayer and a Haldrup plot combine. The Eastern team also utilises specialist equipment, such as a plot forage harvester, that are shared across NIAB's other trials centres located across England and Wales.

Recent years have seen an increase in NIAB's forage maize work in Norfolk as the crop becomes more popular. All the 500 + maize plots that the centre looks after are based at the Morley Farms site. The work on these plots includes variety statutory testing, contract drilling and harvesting.

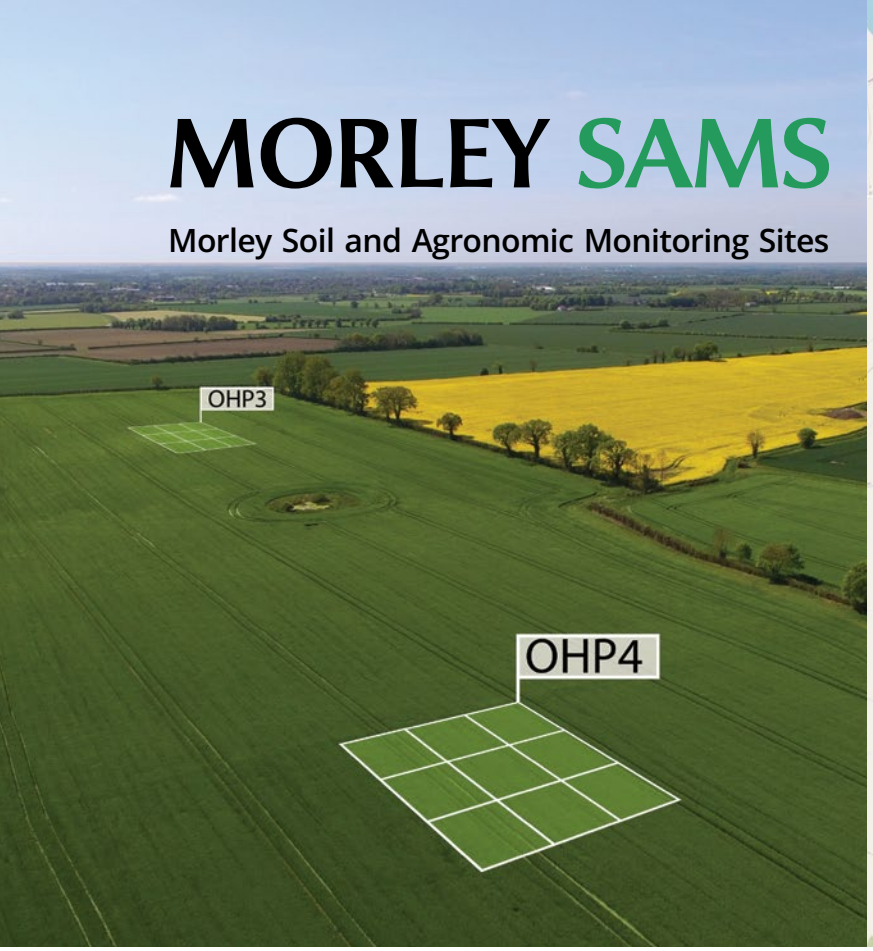
NIAB trial information is available through a range of routes including open events, training courses, member conferences, publications and through the NIAB Website (www.niab.com).

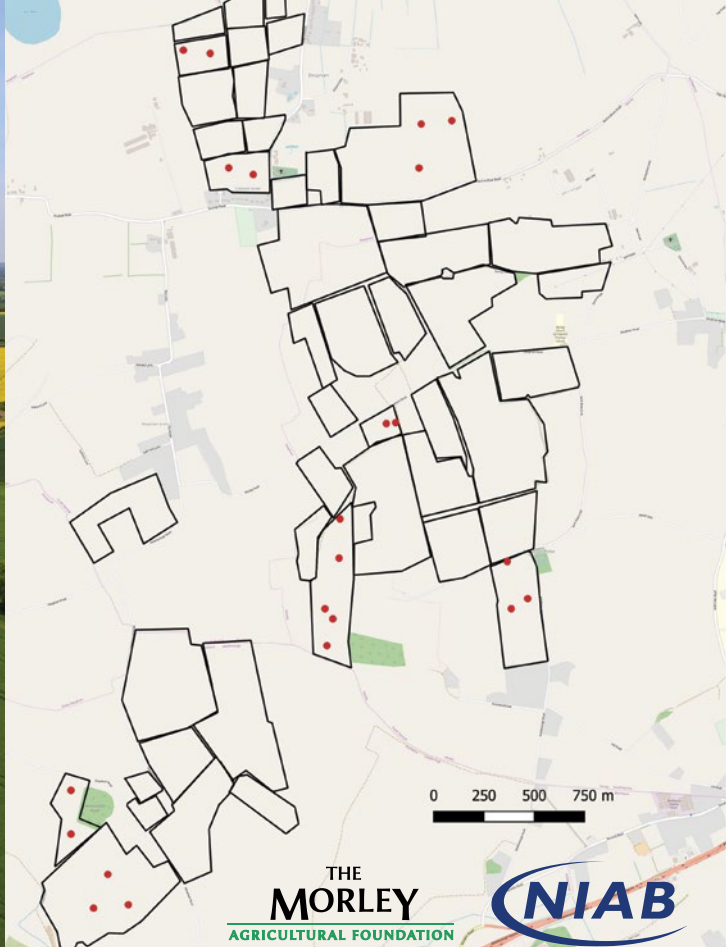
TMAF Grant Commitments

Every year TMAF makes grants to many organisations and individuals to support agricultural research and education. Usually financial grants are made but resources are made available e.g. land, machinery, crops as a benefit in kind.

Beneficiary	Start	Commitment		Project
Royal Norfolk Ag. Association		Annual		Food & farming discovery trust
Hertfordshire Ag. Society		Annual		Herts school food and farming day
Suffolk Ag. Association		Annual		School farm & country fair
Essex Ag. Association		Annual		Essex schools food and farming day
The Aylsham Show		Annual		Food & farming discovery area
Agri-TechE	2019	3 years		Young innovators forum
ADAS	2021	1 year		Yield enhancement network report link high crop yields and environmental impact (2nd year)
Oscar Smith	2021	1 year		IAgrM Farm management skill training programme
8 Agri professionals		Annual		John Forrest award - communication training
2 Agri professionals	2023	1 year		John Edgar rural business management course
David Purdy PhD, Notts Uni	2019	4 years		Biophysical effects of plant root systems on soil health and crop yields
David Purdy PhD, Notts Uni	2022	1 year		Additional microbial analisis for above. (Phospholipid fatty acid analysis and choloroform fumigation test)
Anya Heathcote, Morley PhD fully funded by TMAF 2	2022	4 years		Increasing climate resiliency and yield stability in wheat through genetic improvement of root systems
Abi Brock, Morley PhD fully funded by TMAF 3	2022	4 years		Improving nitrogen use efficiency in cereal crops for sustainable food production
Anisa Blower, CTP-SAI PhD 1	2022	4 years		Exploration of NIAB's synthetic wheat as a new source of disease resistance for effective genetic control of *Septoria tritici*
Ian Tsang, CTP-SAI PhD 2	2022	4 years		Supporting future wheat improvement underpinned by novel genetic diversity for root traits
Elena Bidash,Crop Science Centre, NIAB, PhD	2022	4 years		Manipulating meiotic recombination for crop breading
Lucy Tillier PhD, Notts Uni	2019	4 years		Evaluating sugar beet canopy
Suzanna Harder (nee Cobb), PhD, Notts Uni	2019	4 years		Sugar beet virus yellow strain variation, resistance and variety influence
Paul Chunga PhD, Harper Adams	2019	4 years		Agronomy and genotype in tissue integrity effecting sugar beet losses during storage
Leah Howells PhD, Notts Uni	2021	3 years		Remote sensing and machine learning for field-scale prediction of maturity and yield in vining pea
Amar Hundare, Notts Uni	2018	4 years		CRISPR-Cas9 knockout of S-RNase gene in diploid potato specie, *Solanum okadae*, for production of inbred lines
Ana Prada Barrio, Harper Adams	2022	4 years		The effect of low tyre pressures and controlled traffic farming systems on soil properties and crop development
Bob Froud-Williams	2022	1 year		Review of cultural control of weeds
Kevin King, MSc, Cranfield Uni	2022	1 year		MINion sequencing technology applied to air samples for rapid metagenomic quantification of ascomycete fungi causing arable diseases
Nigel Vermonden, MSc, UEA	2022	1 year		Investigating plant hair development in cotton
TMAF Own Project	2019	5 years		Morley SAMS
TMAF Own Project	2019	ongoing		Morley clean water project
NIAB	2022	6 years		New farming systems, (Evolution previous a 15 year project)
NIAB	2019	5 years		Morley LoTS, (continuation of a longer project)
NIAB	2022	6 years		Exploiting novel wheat genotypes for regenerative agriculture
BBRO	2017	6 years		INSPIRE - Monitoring spatial crop variation throughout crop rotations
BBRO	2023	4 years		Assessing carbon dynamics in sugar beet to achieve Net Zero

Informing young people | Supporting professional development | Supporting PhD and MSc research projects | Fully funded research programmes





Morley SAMS

There are virtually no long-term studies examining the long-term impact of modern agricultural practices at farm-scale on productivity across a rotation, on soil health, and overall farm sustainability. In autumn 2018 TMAF, through NIAB TAG, implemented the Morley Soil and Agronomic Monitoring Study (SAMS). Morley SAMS is a long-term on-farm monitoring programme that aims to link soil health and its impacts on yield, profitability and resilience at Morley. TMAF hope that this monitoring will continue long into the future, e.g. 25 years.

A network of monitoring sites has been identified across the farm. The first step was to use GIS to synthesise the yield data to examine patterns and link these to known patterns of soil variation. The monitoring sites were then selected to include a mixture of historic high, low and variable yielding areas, 4 headland sites have also been included. In total detailed soil and agronomic monitoring will be carried out at 30 sites, each approximately 150 m^2. More sites may be added in later phases of the programme. NIAB is working in partnership with other organisations in the delivery of Morley SAMS. The detailed soil physical characterisation is being carried out in partnership with the James Hutton Institute. All sites in cereals, oilseed rape and pulses are also entered into ADAS Yield Enhancement Network (YEN). This provides modelled potential yield and supports SAMS to carry out comprehensive grain and plant tissue nutrient analysis across all sites. In 2018 and 2019, BBRO also monitored 9 of the 30 sites as part of the BBRO INSPIRE project attempting to identify causes of yield variation in sugar beet. We expect that over the life of the project, and well beyond, the Morley SAMS project and data sets will be used by other organisations, researchers and farmers as a platform for exploring the interactions between crops, soils, weather and agricultural management and helping to underpin sustainable agriculture in East Anglia for generations to come. As the data set grows over the years, more interesting and complex observations can be made. As TMAF is a charity, all information will be openly available to the industry. TMAF would like to hear from any organisation that may wish to offer support and work collaboratively.

For the 2022 harvest Morley farms installed a Crop Scan NIR protein sensor to the combine harvester. This works like a yield map but provides insights into grain quality and when analysed with yield maps can be used to spatially map nitrogen uptake efficiency across the farm.

Morley SAMS data is now available in an interactive map on the TMAF website. The map can be used to view details of the farm soils, pH, earthworm count, VESS, and aggregate stability.

Morley SAMS monitoring

Soil Monitoring
Visual evaluation of soil structure
Penetration resistance
Aggregate stability
Earthworms
Soil mineral N
Soil organic matter
pH, extractable phosphorus, potassium, magnesium, calcium and sulphur
Bulk density
Water release characteristic curve
Exchangeable micronutrients
Respiration assay (CO_2 burst)
Potentially mineralisable N

Rotationally	Annually

Agronomic Monitoring
Plant populations
Green area index (GAI)
Ear numbers
Grass weed head/broad leaf weed population
Disease levels
Yield
Harvest index
Specific weight
Thousand grain weight
Oil content for oilseeds, sugar content for sugar beet
Grain protein, nitrogen and phosphorus content

Explore the Morley SAMS data

A selection of the Morley SAMS data is now available in an interactive map on the TMAF website. The map can be used to view details of the farm soils, pH, earthworm count, VESS, and aggregate stability.

View the Morley SAMS map on the TMAF site: https://tmaf.co.uk/sams-map/

Morley Clean Water Project

THE MORLEY AGRICULTURAL FOUNDATION

Aim

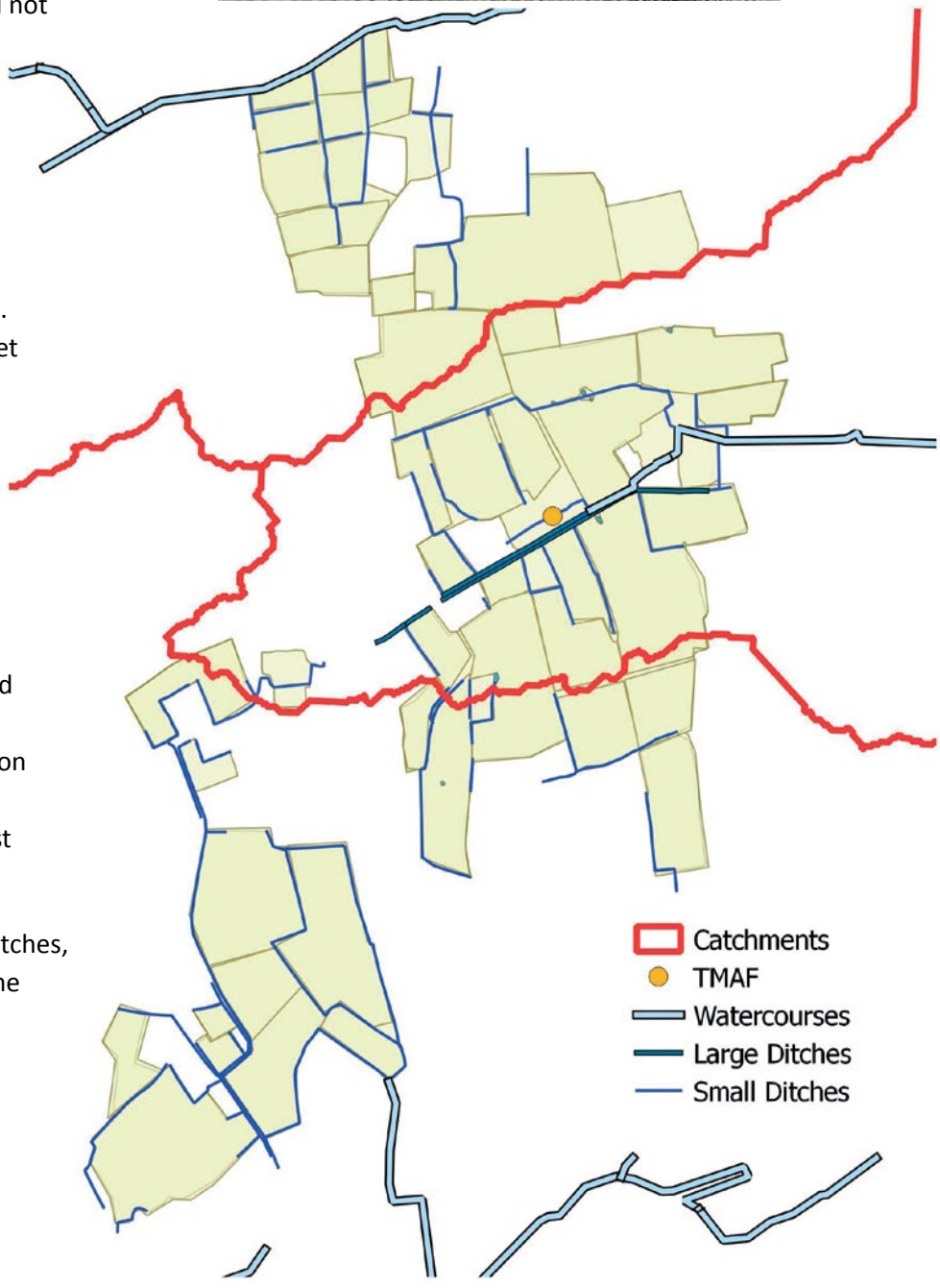
The aim of the Morley Clean Water project is to take measures to ensure the water leaving the farm is as clean, or cleaner than when it arrived. The motivation is that we want to be good farmers and custodians of the landscape, but also to demonstrate good practice to other stakeholders. Any activities or measures employed should be at a modest cost and effort. For example, alterations can be done to farm ditches or farm tracks with just farm labour, skills and machinery. Any such intervention will not compromise crop productivity, e.g. field drainage will not be impeded.

What's clean water

Ultimately clean water is water that meets the UK drinking standards. In the context of this project the target is to reduce nitrate, phosphate and turbidity. Turbidity is a measure of solid particles in the water. However, it is well known that pesticides and nutrients attach themselves to soil particles.

We hope to continue to work with Norfolk Rivers Trust, Anglia Water, and UEA. There have been many research projects identifying pollution mitigation measures over the years. We want to draw from this to demonstrate best practice on the farm.

The first task was to identify all the ditches, and where the water goes. Most of the small ditches are not marked on any published map. We have now drawn every ditch onto a map using GIS software.



Map showing the morley waterways

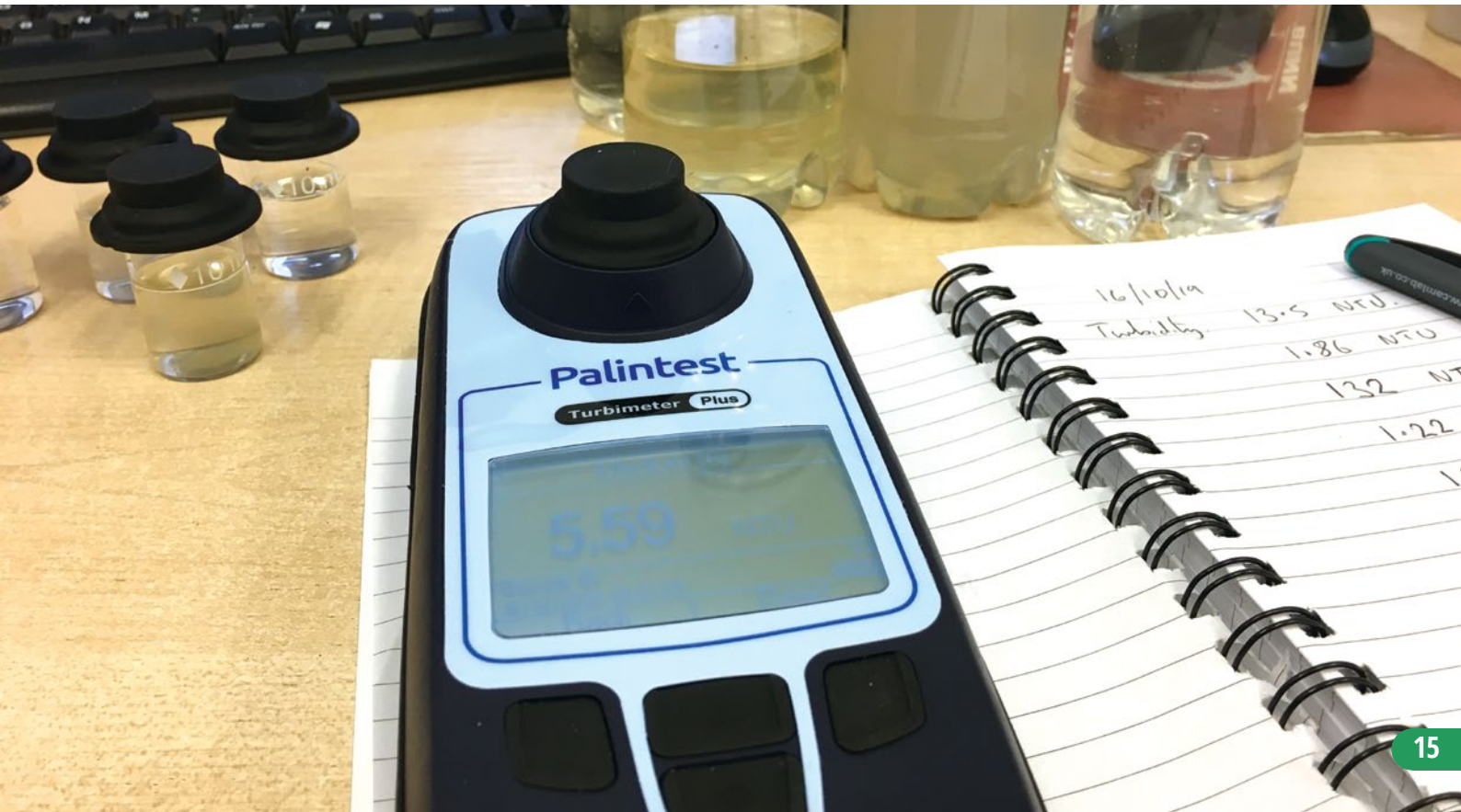
Making a difference

Farm tracks can be a problem. When it rains they convey water, and with traffic the water can carry a lot of sediment. The brown water in most cases is diverted into a water course. At the farm, we have installed cross drains which divert the water away into a shallow swale where the water can soak into the ground leaving the sediment on the surface. The farm has also reconfigured the area used for the pressure washer rather than the dirty water making its way to the ditch via a drain. The washing area is contained and isolated from the yard drains. The water is diverted into a small pond, lined with concrete railway sleepers where the water can settle and sediment remains and can be dug out periodically.

Water testing

To get an understanding of what the background water quality is like, water quality measurements are being taken and different locations. Using a colorimeter we hope to be able to identify areas of most concern.

Progress and results will be published on the TMAF website and at open events.



Morley LoTS, Long Term Studies

In 2019 funding by TMAF for the MENTOR series of projects came to an end. This included a number of long-term trials. Following consultation with farmers and agronomists at the MENTOR agronomist workshop in February 2019, many of the projects will continue but with some alterations. The changes are brought about by the need to keep them relevant to UK agriculture and avoid the repetition.

Disease response monitoring in winter wheat

This trial has evolved over the last 30 years. It is a range of fungicide programs applied to winter wheat throughout the season. It is designed so that the value of T0, T1, T2 and T3 fungicide timings can be realised and of course how this varies over the years. Going forward the fungicide programs will change as septoria and rust strains evolve. An additional variety will be included, this will have low disease susceptibility. More detailed molecular diagnosis looking at stem-based diseases will also be carried out.

Disease response monitoring in winter barley

This is similar to the wheat trial mentioned above. There is increasing concern about the impact of ramularia on barley; simple disease observation provides relatively little information but molecular-based tests are now available and although still relatively costly can add significant additional information, where disease monitoring is carried out, especially in long-term trials. The trial will continue monitoring the value of T1 and T2 fungicides over the years but also more detailed measuring of ramularia and net blotch using molecular diagnostics.

Sugar beet periodic lift trial

This long-standing trial harvests plots of sugar beet throughout the campaign. Also simple fungicide treatments will be included. This trial will continue with consultation with BBRO to avoid repetition and to keep it relevant to the industry.

An additional trial will examine the benefit of sugar beet treated with Frass (insect waste) as a biorepellent to reduce disease and virus yellows.

STAR cultivations and rotations trial, Otley

The long-term STAR (Sustainability Trial for Arable Rotations) project (medium/heavy, clay loam soil) in Suffolk was established in 2005 to investigate interactions between cultivations for crop establishment and crop rotation and their impacts on yield, margin and wider impacts on crop, soil and weeds. The STAR project uses fully replicated large plots (36 x 36 m) with farm scale equipment and techniques. Primary cultivation practices are inversion (c. 25 cm plough) and non-inversion tillage (using the subsoiler / disc-based combination, Sumo Trio) set either deep (c. 20-25 cm) or shallow (c. 10 cm). The Felix Thornley Cobbold Trust (FTCT) and, historically, the Chadacre Agricultural Trust provide support for the STAR project. TMAF will provide some financial support going forwards.

Modelling long-term trends

Following the agronomist workshop it was realise there is a opportunity with extra resources to further analyse the data created over the years. This work will be delivered by working in partnership to draw on data analysis, modelling expertise and to establish links with other long-term experimental sites (Rothamsted, SRUC and more widely). This work will also draw together other long-term projects e.g. Morley SAMS and NFS.

These projects have produced findings that have been, and continue to be, presented at numerous events throughout the year including: national and international conferences; open events and workshops; and also scientific papers and printed journals. The results from all the above projects are available on the NIAB website. As the NFS, NAC, MENTOR and Morley LoTS projects are funded by TMAF the information is available to all.

Bringing long-term data sets together

A CENTA (a doctoral training partnership) PhD with Cranfield University, BGS, and NIAB is developing a structured approach to disentangle the drivers of crop productivity across the crop rotation with a particular focus on spatial/temporal interactions at farm-scale. The high data density available for Morley (e.g. plot trial data, yield maps and the Morley SAMS project) will be used to develop integrated modelling approaches with site-specific calibration to support in-season and between-season rotational management decisions.

Exploiting novel wheat genotypes for regenerative agriculture

NIAB's pre-breeding department has worked for many years to increase the genetic diversity of wheat. Some of the breading lines are not only producing improved yields but also a range of traits e.g. nutrient use efficiency. This project aims to select and test a group of novel wheat genotypes on sites that use regenerative principles. One of the sites is the legacy of the New Farming Systems (NFS) where plots have either been shallow or deep cultivated or ploughed for 15 years. Other East Anglian sites with a known history have been selected.

Sugar beet field trials

Morley Farms is one of BBRO's demonstration farms. The site enables BBRO to explore the application of new technologies and agronomic practices at commercial scale. The farm also hosts BBRO scientific replicated plot trials.

Current areas of investigation include:

- BBRO pellet type, investigating emergence speed, final emergence, and crop yield of various pellets.
- Recommended list trial to test the genetic potential of new candidate varieties and to recommend the best for use in the UK.
- Storage resilience – a PhD project in conjunction with TMAF, BBRO and Harper Adams University investigating the potential for calcium and boron sprays to improve the resilience of stored beet and reduce sugar loss in storage.
- Beneficial insect strips – A wildflower mixture looking at the potential for in-field strips to encourage beneficial insects and reduce aphid pressure.
- Endophyte grass: Sowing endophyte-containing grass in the autumn ahead of the beet crop, before destroying it at beet drilling, to build virus resistance. This has now progressed from a strip trial to randomised plots for the 2023 beet season.
- Strip trials of under-sown barley, to investigate if barley can confuse aphids trying to identify sugar beet plants, and reduce levels of virus in the beet.
- Camo-cropping; spraying non-toxic colour dyes onto aphid-vulnerable beet plants, to prevent aphids identifying the beet plants. Looking at various rates of dye and the efficacy of different colours (red, green, and blue).

Assessing carbon dynamics in sugar beet to achieve Net Zero

With an industry target to reach net zero in agriculture by 2040, it is imperative that emissions are quantified and addressed on farm. Currently, this is driven by the use of carbon calculators which use greenhouse gas emissions data on inputs and outputs to calculate overall. These calculators in many cases rely on poor data and assumptions about the practices used.

This project will be an industry-leading carbon measurement project. A pair of flux towers in two neighbouring fields will measure carbon emissions from and uptake into the sugar beet crop. Each field will have different management practices, such as cover crop vs. stubble and ploughing vs. reduced tillage. Crop and soil carbon will also be assessed to understand carbon sequestration. Yield will be recorded to understand the balance between optimising yield and reducing emissions. The aim of the project is to calculate carbon emissions from a sugar beet field under typical management practices and quantify the impact alternative approaches have on emissions.

Saxmundham Long-term Study

THE MORLEY AGRICULTURAL FOUNDATION

In 2013 TMAF agreed to a 20 year lease of a long-term trials site at Saxmundham, Suffolk. This 4 ha field was set up over one hundred years ago to compare manure and bagged fertiliser use. While there have been some changes to this field trial over the last century the basic study is still in place today.

The initial goal of the work was to demonstrate that farmyard manure was not the Holy Grail of farming and that so-called "artificials" (nitrogen (N), phosphorus (P) and potassium (K)) could achieve the same results. This area of debate is still a contentious one today, but perhaps the emphasis is now on what benefit farmyard manures can bring over 'artificials'!

The study, comparing long-term additions of manure, P, K or no input, had been maintained historically through local support, but over recent years the site had fallen out of use. The 20 year security of the site will ensure the value of the site is maintained. The site is managed by NIAB with the support of local growers and agronomists. The field is already proving useful to other research programs to understand the contribution of organic matter to fertility, structure, biology and function of soil.

New in 2020

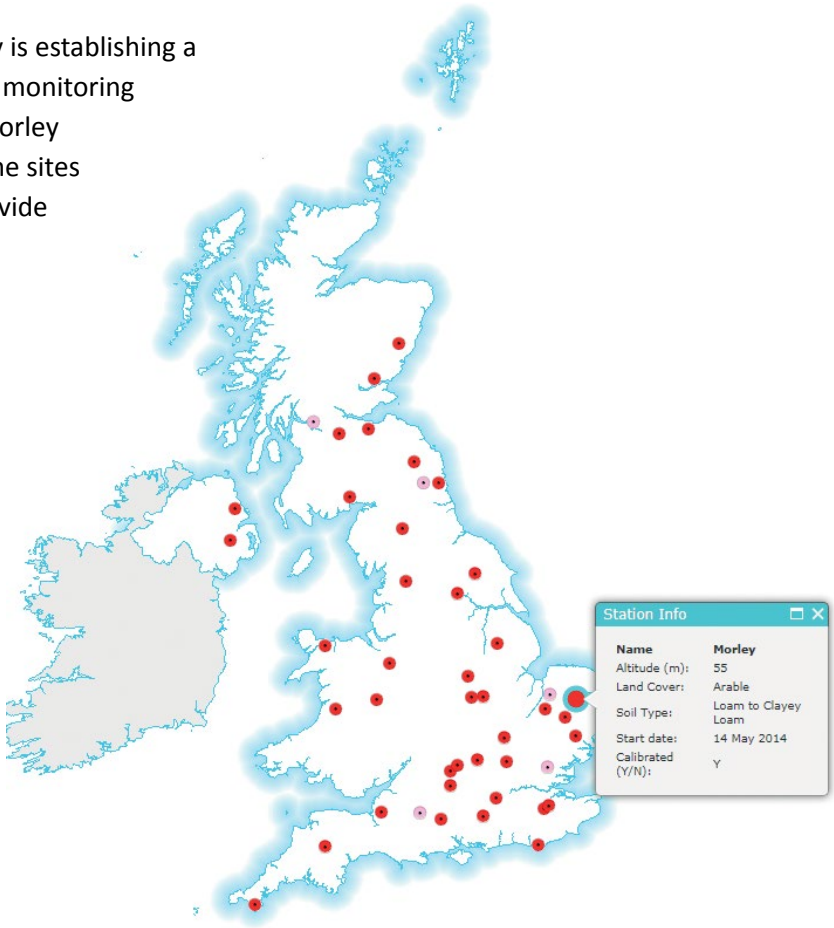
In 2020 two historic treatments that have not been maintained and soil tests confirm have returned in line with untreated will be replaced with two new treatments:

1) The Bone Meal plots will be replaced with green waste compost applications that match the organic matter inputs from the FYM treatment, typically around 1:1, so 25 t/ha. These plots will also have additional bagged P fertiliser to try and maintain a P Index 1 but increase organic matter levels. This will hopefully help answer the question: can we, through improving soil organic matter and the benefits this brings, maintain yields on an Index 1 P soil compared to Index 2?

2) The historic N plots will not receive any form of organic or inorganic soil-applied P, but instead, multiple foliar P spray applications in an attempt to understand how much P can be supplied to the crop through this means.

Cosmic-ray Soil Moisture Monitoring Network

The Centre for Ecology & Hydrology is establishing a long-term network of soil moisture monitoring stations for the United Kingdom. Morley Farms has been chosen as one of the sites in East Anglia. The network will provide near-real time soil moisture data for use in a variety of applications including farming, water resources, flood forecasting and land-surface modelling. The station is equipped with an instrument that uses cosmic-rays to sense soil moisture over an area of almost 40 hectares (about 100 acres). Data from the network have the potential to transform the way that we understand and model the natural environment.



More information is available from www.cosmos.ceh.ac.uk and is part funded by Natural Environment Research Council (NERC).

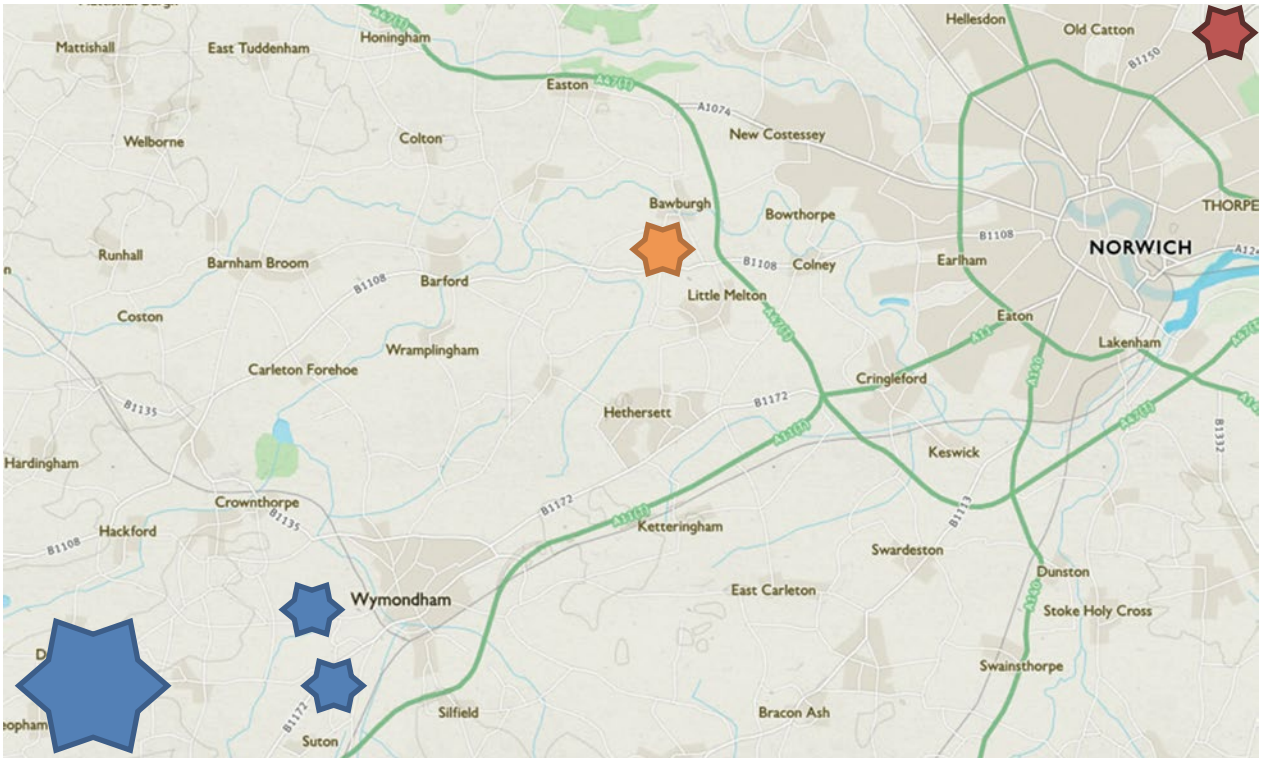
Morley Farm Weather Station (MFWS)

The weather effects everything that happens on the farm, and what we do, and when. Our decision-making is helped by the information from our weather monitoring equipment.

We have recently updated our system, and can now share the data with website visitors. We have 11 different measurements from air temperature to windspeed, all available direct from the Morley Farm Weather Station. This data is freely available. Contact us from the link below to receive access details.

https://tmaf.co.uk/weather-data/

The Morley Agricultural Foundation Land Holdings



Land owned by TMAF rented to Morley Farms Ltd.

Land owned by John Innes Centre rented to Morley Farms Ltd.

Land owned by TMAF rented to Wroxham Home Farms.

Contact The Morley Agricultural Foundation

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Every effort has been made to make this document accurate as of January 2023

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FARMS LIMITED