Title: Undersowing maize ground with PRG and other varieties.

Principle investigators: Mrs Nicola Naylor and Mrs Louisa Dines

Named collaborators: Dr Robert Wilkinson, Dr James McCaughern, Mr Chris Ruffley, Mr Simon Jeffries.

The gradual shift from the Basic Payment Scheme towards the Environmental Land Management Scheme (ELMS) will focus farmers attention on issues such as encouraging wildlife, reducing environmental pollution and minimising climate change. Greater emphasis will also be placed on maintaining soil structure, soil health as well as increasing the water and nutrient holding capacity of soils and preventing erosion. The introduction of a range of cover crops, mixed species lays as well as under sown maize crops, will bring about a range in rooting depths within soils and help to alleviate winter flooding (Beaty, 2020).

Maize silage is a common forage used by dairy and beef producers, as well as being grown for use in anaerobic digesters, with 183,000 ha being grown in England in 2017 (Statista, n.d.). In order to protect the future of food producing ground, there is an urgent need to protect the soil. Whole crop maize is normally harvested for silage production in September/October with the ground often being left fallow over the winter period. This increases the risk of surface area run off, as well as compaction due to heavy machinery usage, nutrient leaching, and soil erosion. DEFRA (2020) estimated that soil erosion and compaction had an external cost, within England and Wales, of £350 million in 2010. Current thinking explores the concept of under sowing grass in to established maize crops. Under-sown crops have the ability to bind soil and take up nutrients as they grow, as well as improving soil organic matter levels, however the effect on maize yield is unknown. Not only will under sown grass have the potential to improve soil, it also provides an additional feed for livestock. There is need to determine the effect of crop variety on maize yield as well as on growing lamb performance. MGA (2017) investigated the use of Italian Rye Grass and found no significant impact on the yield, ME content and starch content of the maize crop, however significant reductions were seen in the level of Nitrogen leaching.

In the future sheep farmers will need to focus their attention on increasing productivity by improving stock health and performance. The UK sheep industry currently stands at 32.7 million head, where production is predominantly grass based, with over two thirds of current agricultural land being composed of grassland. Herbage is thought to supply up to 95% of dietary requirements depending on stage of production (Earle *et al,* 2017). With current uncertainty around Brexit, and future trade negotiations with Australia and New Zealand, it is imperative that the UK sheep industry continues to move towards a more sustainable and low-cost system. It is well documented that sheep are vulnerable to higher worm burdens in areas where grazing had occurred previously, and with anthelmintic resistance a growing problem globally, it is important to utilise land which has had no previous grazing in order to reduce the use of anthelminitics and ultimately slow down the development of resistance within flocks.

Perennial rye grass (PRG) is the most frequently used grass type, although utilisation may vary between 50-80% depending on age of the crop and the grazing system adopted (AHDB, 2018). Modern PRG varieties have the potential to yield between 12-15t DM/ha under high levels of Nitrogen application (O'Donovan 2011), with crude protein (CP) concentrations of 250g/kg DM and metabolisable energy (ME) values of 11.5MJ/kg DM being achievable (Germinal, n.d), however growth may be slow during the autumn months, when maximum herbage yield is required for sheep feed. Festulolium (a range of crosses between fescues and ryegrasses) is a newer species of grass, particularly useful in stress prone sheep fields, where it's resilience to disease and drought as well as hardiness to winter conditions make it a suitable alternative to PRG. Although it has a very similar ME to PRG; 11.5MJ/kg DM (forfarmers, n.d.), it's combination with an Italian Rye Grass (IRG) is hoped to produce a high yielding drought resistant grass ley.

Methodology

Maize growing: 20-24 maize plots will be drilled in May 2021, then were each individually undersown, following random allocation to one of four treatments (PRG, PRG & WC mix, Festulolium & IRG) or control; left bare) in June 2022. At the point of harvest (late September/early October), yield will be recorded and a sub sample of maize taken from each plot.

Lamb growth: The study will be conducted at Harper Adams University between December 2021- February 2023. Post-harvest (end September/early October), lambs will be allocated to one of three treatments (PRG, PRG & WC mix, Festulolium) LWT. Plots A minimum of two plots will be used per treatment. Assuming minimal or zero growth between October – December, lambs will be stocked at an expected rate of 9 lambs/ha to ensure lambs can achieve dry matter intakes of 3.5% LWT. Lambs will be grazed in a strip grazed system. Lambs will be weighed weekly throughout the study, and weighed again at the end. Dry matter availability will be measured via a rising plate meter. Measurements will be taken prior to grazing and then weekly, with a final measurement being taken once lambs have been removed from the plot. Forage samples will also be taken at the same intervals. Weekly grass growth will also be measured on one of the un-grazed plots at 4 fixed points in each plot. Diet digestibility will be determined in week 3 of the study using acid insoluble ash as an indigestible marker, using the equation:

DM digestibility = (Faecal AIA conc – Feed AIA conc) / Faecal AIA conc

Faecal samples will be collected from 6 lambs on each treatment over a five-day period. These faecal samples will subsequently be bulked, mixed, and sub-sampled on an individual animal basis prior to chemical analysis.

Analysis: At the end of the study, feed samples will be analysed by wet chemistry for dry matter (DM), crude protein (CP), ether extract (EE), ash, AIA, neutral detergent fibre (NDF), acid detergent fibre (ADF), starch and gross energy (GE). Data will be analysed by ANOVA as a randomised block design using Genstat 20.

Costings

Direct staffing costs	£3200
Laboratory costs	£500
Additional costs	£4000 (including water provision)*additional costs of £2,400 may be incurred for fencing should these not be provided by other funds)*
Total cost	**£7,700**

Milestones and achievements

Project milestones[1]	**Completion date**
Drill maize plots	May 2022
Harvest maize and finish crop-based data collection	October 2022
Recruit all animals onto the study	December 2022
Finish performance collection and laboratory analyses	February 2023
Prepare final report	March 2023

References:

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Statista (n.d.) Total area of maize in the United Kingdom (UK) as of June 2017, by country. Available from: https://www.statista.com/statistics/530647/maize-area-hectares-united-kingdom-uk/ [Accessed 16 July 2021].

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