moorepark open day

The key role of white clover

Michael Egan
Research Officer, Teagasc.

Brian McCarthy
Research Officer, Teagasc.

Deirdre Hennessy
Research Officer, Teagasc.

The Ag Climatise policy document, published by the Department of Agriculture, Food and the Marine in 2020, set out a number of measures to achieve a reduction in chemical nitrogen (N) fertiliser use. These measures include a reduction in N fertiliser allowance for dairy farms, increased liming and use of Low Emission Slurry Spreading (LESS) to increase N use efficiency and the incorporation of white clover into grass swards to replace chemical N fertiliser with biologically fixed N.

Recent clover research at Teagasc

Research undertaken at Teagasc Clonakilty found that incorporating white clover into intensively managed swards increased annual herbage production by 1.2t DM/ha, on average, relative to grass-only swards (where both sward types received 250kg N/ha) over a four year period, with a sward clover content of 23%.

However, research at Moorepark and more recently Clonakilty has shown that in grass-clover swards, N fertiliser can be reduced by up to 100kg N/ha, while maintaining similar levels of herbage production (13.5t DM/ha), when a sward clover content of >20% is achieved, compared to grass-only swards receiving 250kg N/ha.

As well as potential savings in N fertiliser, including clover in grazed swards can result in increased animal performance.

Typically, when clover is included in grass swards, the nutritive value of the sward in mid-season tends to be higher, compared to grass-only swards.

Recent research at Teagasc has shown that milk solids production increased by up to 20kg milk solids/cow/year when clover was included in the sward (Table 1).

The increase in animal performance is particularly evident from June onwards, when sward clover content is greatest.

This was associated with higher farm profitability on grass clover swards of €305/ha compared to grass-only swards. Nitrogen use efficiency was measured in Teagasc Moorepark over a four year period.

Nitrogen use efficiency increased from 40% on the grass-only swards receiving 250kg N/ha, to 59% on grass-clover swards with 150kg N/ha.

The increase in N use efficiency was largely driven by the reduction in N fertiliser application and the increase in milk production.

Establishing a grass clover sward

Establishing white clover at sufficient levels on dairy farms to offset the reductions in chemical N fertiliser use will be a challenge, however, the correct sowing and grazing management practices post-sowing will greatly help white clover establishment.

Table 1: Results from recent research in Teagasc Moorepark and Clonakilty.

	Moorepark[1]		Clonakilty[2]	
	Grass-only 250kg N/ha	Grass-clover 150kg N/ha	Grass-only 250kg N/ha	Grass-clover 150kg N/ha
White clover content (%)	-	22.0	-	16.8
Grass production (t DM/ha)	13.5	13.4	15.1	14.4
Milk yield (kg/cow)	6,068	6,331	5,521	5,744
Milk solids yield (kg/cow)	490	510	470	487
Nitrogen use efficiency (%)	40	59	-	-

[1]Moorepark – data is from 2013 to 2020

[2]Clonakilty – data is from 2019-2020

Incorporating white clover in a full reseed is the most reliable method of establishing white clover in a sward, as it gives it a better chance to establish and also provides the best opportunity for weed control.

Over-sowing is a simple and low cost method of introducing white clover into swards.

Success, however, is very much dependent on weather conditions around sowing, soil moisture, post-sowing grazing management and competition from the existing sward.

Therefore, there is a certain amount of risk associated with this approach and it should be undertaken early in the year (early April to late May).

Some key points when using both methods include:

•Ensure optimum soil fertility (i.e pH > 6.3, index 3 for P and K).

•Reseed/over-sow as early in the year as possible – spring/early summer.

•Graze swards tight for at least the first three grazings post-sowing/over-sowing, keeping pre-grazing herbage mass < 1,100kg DM and grazing swards to ≤ 4 cm.

•Avoid over-sowing old 'butty' sward with a low perennial ryegrass content – a full reseed is best in these conditions.

•Avoid over-sowing large areas of the farm at once, as it can be difficult to maintain the correct pre-grazing herbage mass (<1,100kg DM/ha) on large areas at once.

For more information on establishing and managing grass-clover swards, download a copy of the *Management and establishment of grass-white clover swards* from the Teagasc website.

Increased milk yields and milk solid yields from white clover

Ellen Fitzpatrick
Walsh Scholar Teagasc.

Where access to additional land is limited, any increase in production forces farmers to either increase herbage production, feed higher levels of supplementary feed or consider alternatives, such as partial mixed ration (PMR) or total mixed ration (TMR) feeding systems.

However, a unique selling point of Irish milk is that it is produced from pasture and the inclusion of white clover in swards of PRG can offer increased nutritive value of the herbage, improved animal performance and reduced nitrogen (N) application rates.

My study at Teagasc, Moorepark, is looking at dairy cow performance across five different feeding systems – TMR fed to cows indoors using a roughage intake control system, a 50% TMR, 50% grazing PMR feeding system, grass-clover swards receiving 150kg N/ha, grass-clover swards receiving 100kg N/ha and grass-only swards receiving 250kg N/ha.

Results over recent years have indicated that the incorporation of white clover into grass swards results in greater milk yield and milk solids yield compared to grass-only swards. The increased feed available to the TMR and PMR treatments likely increased dry matter intake, resulting in the increased milk production.

In addition, the feed quality of TMR is less variable than that of grass-based systems throughout lactation. This helps to maintain a higher milk yield later into lactation.

moorepark open day

GreenFeed machines measure methane

Katie Starsmore
Walsh Scholar Teagasc.

Ireland's agriculture industry currently contributes 34.3% of total national greenhouse gas emissions. Methane is the largest component at 59.3% (EPA, 2021).

The Government has committed to reducing total emissions by 51% by 2030, relative to 2018 levels. This will generate pressure on all sectors within Ireland to play a role in reducing emissions.

Given the importance of methane in agricultural emissions, it is important that research is completed to evaluate the baseline methane emissions, as well as the potential for methane reductions through, for example, grass quality, animal characteristics, as well as complementary feed-based solutions.

Methane measurement

The majority of methane emitted from ruminants is released through burping/belching. Hence, methane measurement is focused on sampling air from the animal's mouth.

At Teagasc Moorepark, we are measuring methane using a device called the GreenFeed, which can measure approximately 25-30 animals in a pasture setting. These GreenFeed machines rely on the animal to voluntarily visit the machine as many times as possible per day to ensure accurate results.

When the cow puts her head into the feed bin of the GreenFeed, her electronic identification tag is recognised and sampling commences. While she has her head in the feed bin, small amounts of concentrate (35g) drop every 20 seconds over two to three minutes.

This encourages the cow to stay in the machine for the required period. While she is eating, air is sucked in through the feed manifold. This air is then filtered by methane, carbon dioxide and hydrogen gas sensors on the machine. GreenFeed machines are mobile and are moved to follow the grazing rotation, so cows have constant access to them.

Moorepark research

At Teagasc Moorepark, there are ongoing trials working on different mitigation strategies to reduce methane emissions at a cow and herd level. The trials completed to-date have shown that the data being collected is accurate and robust.

Therefore, the estimated methane emissions are reliable for the Irish grazing system. There are trials currently being carried out to measure methane on over 150 individual animals.

These trials are focusing on the effect of white clover, stage of lactation, feed additives and genetics on methane emissions. Other aspects of methane mitigation that are being explored are:

- Grazing management.
- Feed quality.
- Genetics/breeding.
- Rumen environment.
- Feed additives.
- Supplementation strategies.

OPTIMIZE YOUR OUTPUT

Giving life to your crops

IFI Net Nitrate: 27%N
Renowned for reliability and consistency, high quality granular CAN, the leading performer on Irish farms for decades.

IFI Super Net: 27%N, 3.7%S
Proven as a reliable source of Nitrogen (N) and Sulphur (S), for cereals and grassland, on Irish farms for over 30 years. High quality granular CCF product.

IFI Sweet Net: 23%N, 5%Na, 2%S, 1.4%Mg
Designed to improve palatability and increase intake of grazed grass. With added Sodium (Na) for palatability, Sulphur (S) to improve grass yield and Magnesium (Mg) for enhanced animal health.

IFI

moorepark open day

Computer model predicts grass growth

Elodie Ruelle
Teagasc Research Officer.

In pasture based systems, farmers must make daily management decisions to ensure that good quality feed is available to their livestock both during the grazing season and housing period.

Being able to predict grass growth for the following week at farm level helps farmer to better anticipate variations in grass growth.

The Teagasc Moorepark St Gilles Grass Growth (MoSt GG) model is a dynamic model working at the paddock and farm level.

The on-farm grass growth prediction project started in 2018 with 30 farms involved. The project now includes 57 farms and this number will soon be increased.

The grass growth prediction is for the week ahead, is specific to each farm, and takes into account soil type, grass management, fertiliser applied and weather (past and future).

Since August 2020, the grass growth predictions are also available at the county level (using the farm prediction data).

Grass growth predictions are available free of charge on the landing page of PastureBase Ireland, in the grass 10 newsletter as well as during the farmer forecast on RTÉ One.

They are also publicised on the Teagasc and Met Éireann twitter feeds.


Elodie Ruelle.

Which is more efficient: rotary or herringbone?

Milking accounts for almost one-third of a dairy farmer's daily workload.

John Upton
Teagasc Research Officer

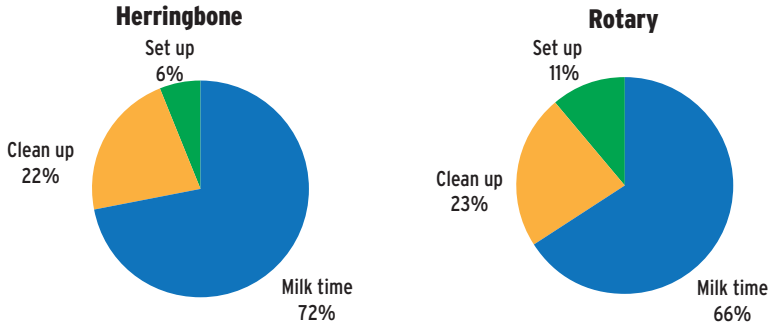
Fergal Buckley and Ryan Prendergast
Walsh Scholars Teagasc

In a Teagasc farm survey, milking process efficiencies were documented on herringbone and rotary dairy farms using video cameras and infrastructure surveys.

The average total milking process time for the herringbone group was 1 hour 45 mins and 2 hours 25 mins for the rotary group.

The average cow throughput was 105 cows/hour for the herringbone group and 155 cows/hour for the rotary group

Figure 1: Breakdown of milking process times for Herringbone and Rotary milking systems.



The aim of the survey was to generate a descriptive profile of all facilities, as well as establish the presence of automation on the farms. Recording of video data took place over one week on each farm.

The milking process was divided into three distinct stages:

• Set-up time – first cow in holding yard until first cluster attached.
• Milk time – first cluster attached until last cow out of last row.
• Clean-up time – hanging up of first cluster until hosing of facilities was complete.

The total process time was defined as the first cow in the holding yard until hosing of facilities was completed. The times presented here are an average of morning and evening milkings.

Results - infrastructural survey

• **Herringbone:** The herringbone group consisted of a sample of 17 farms. The average herd size was 174 cows (ranging from 70 to 336 cows). The average number of milking clusters was 18 units (ranging from 6 to 36 units). One farm had a double-up system as opposed to a swing-over system. Automatic cluster removers were installed on 88% of the farms, 41% had automatic feeders, 59% had automatic entry/exit gates, 24% had automatic backing gates and 12% had a rapid exit system installed.
• **Rotary:** The rotary group consisted of 10 farms. The average herd size for the rotary sample group was 386 cows (ranging from 275 to 570 cows). The average rotary farm had 50 units (ranging from 44 to 64 units).

Automatic cluster removers were installed on all of the farms, 70% had automatic teat sprayers installed and 60% had automatic backing gates.

John Upton with a milking machine analyser used to test vacuum and pulsation.

Results – video recording

• **Herringbone:** The average total process time for the herringbone group was 1 hour 45 mins (ranging from 1 hour 1 min to 2 hours 48 mins). Average set-up time was six minutes (ranging from one minute to 21 mins). Average milk time was 1 hour 23 mins (range 53 mins to 2 hours 24 mins).

Average clean-up time was 25 mins, (ranging from 10 mins to 52 mins). Average number of operators present at milking was 1.5, with 42% of the sample having more than one person present at milking.

Average number of rows recorded was 10 (ranging from six to 20). The average milking efficiency was 105 cows per hour (range 52 to 200).
• **Rotary:** Average total process time for the rotary group was 2 hours 25 mins (ranging from 1 hour 55 mins to 2 hours 59 mins).

Average set-up process time was 17 mins (ranging from six minutes to 33 mins). Average milk time was 1 hour 40 mins (ranging from 1 hour 8 mins to 1 hour 58 mins). Average clean-up time was 34 mins (ranging from 25 mins to 44 mins).

For 70% of rotary farms, there was only one operator present at milking, however 30% of the sample had two operators present at milking. The average milking efficiency was 155 cows per hour (ranging from 78 to 189).

Conclusion

Rotary farms had longer milking process times and higher cow throughput compared to herringbone farms.

The farm-to-farm variability between herringbone and rotary systems warrants further investigation, in order to identify the factors that have the largest influence on milking efficiency.

The future work of this research project will seek to determine where maximum reductions in milking process time can be achieved.

Eliminating chlorine treatment from the dairy

David Gleeson
Teagasc Research Officer

David Gleeson (pictured right), has led research into eliminating chlorine from dairy equipment cleaning procedures.

He says: "Successful cleaning without chlorine requires changes to previous cleaning protocols. These include re-calibration of detergent dosing equipment and an increased use of hot water and acid-based products.

"While choosing a good-quality detergent product is important, following the steps of one of the recommended wash protocols is critical."

moorepark open day

Collaboration makes a lasting impact

Mark Moore
Teagasc.

Pat and Mairead McLoughlin with Jim Moyles.

According to Joe Patton, head of the Teagasc Dairy Knowledge Transfer programme: "The success of a research programme can be gauged by its impact on farm management practice over time. We have seen over many years that when farmers, researchers and advisers work together on important issues, real progress can be made. Improving milk solids, reducing somatic cell count and uptake of grazing management skills are all good examples.

"A key strength of the Teagasc model has been excellent two-way communication of ideas and solutions between farmers and the research centres. Teagasc advisers and specialists have played a vital role in facilitating this process."

The experiences of Mairead and Pat McLoughlin and the members of the Birr dairy discussion group are a case in point. The husband and wife team farm 70 dairy cows. Their previous Teagasc adviser, Mark Coyne, encouraged them to concentrate on dairying rather than beef when they took over the farm in 2014.

Keen to farm sustainably (they won both the Lakelands and Overall National Bord Bia Origin Green Sustainability awards in 2018), they have always included clover in their reseed mixes. However, like many farmers, they had seen the percentage of clover gradually reduce in the subsequent years.

"Jim Moyles, our dairy adviser, from Teagasc Tullamore who facilitates the Birr dairy discussion group, encouraged members to attend the Teagasc annual dairy conference in Mullingar in 2019, where clover was a central theme.

"We heard presentations by Teagasc Moorepark researchers including Brian McCarthy, who explained how we could enhance our management of clover," says Pat. "We hadn't been to Teagasc Moorepark, they came to us!"

According to Jim Moyles, the members of the Birr group are highly engaged and enthusiastic to learn from each other as well as outside sources. The 13 individual members often take a lead on a specific topic, effectively acting as pathfinders on a new technology.

"Pat and Mairead have implemented new ideas on clover management, which they have sourced from the Teagasc conference as well as via the internet, magazine articles, conferences and directly from Teagasc researchers," Jim says. "The group has already met 12 times to-date in 2021, often via Zoom."

"In 2019, with growing confidence from research results, we began gradually reducing the amount of nitrogen we applied on the grass/clover swards," adds Pat.

"On our primarily grass plots on the milking platform, we now apply around 200 units of N per acre, which yields about 14t of DM/ha per annum. On the clover plots, we apply only about 60 units, which is extremely low, but these paddocks yield very similar to the grass-only paddocks at 13-14t of DM per hectare."

In 2021, Pat was invited to join a national group focused on clover facilitated by William Burchill, who works on the Teagasc/Dairygold joint programme.

"Our strategy is to bring together farmers who are enthusiastic about clover to share ideas and experiences and bring those ideas back to their own discussion groups," says William.

Mairead is in her second year as chairperson of the Birr discussion group. "It's not straightforward to manage new technologies on-farm and our success with clover is thanks to input from the researchers, Jim our adviser, as well as constructive comments from other farmers both local and across the country."

Beefing up dairy

Alan Twomey
Research Officer, Teagasc.

Farmers spend weeks scrolling through AI catalogues and active bull lists. Multiple discussions are had with advisers to identify the ideal team of dairy bulls, but when it comes to beef bulls, the discussion can boil down to 'whatever easy calving and short gestation beef bull is available'.

With a growing dairy herd, the improvements in fertility and the availability of sex semen technology, beef bulls are increasingly being used on dairy cows. Although many regard beef calves as a by-product, these animals are far from it.

The majority of animals now being slaughtered in Ireland are bred from dairy cows. Integration of the dairy and beef sector is vital, and it can't all be one-way traffic. For this symbiotic relationship, dairy farmers need to deliver a calf with superior beef genetics to ensure the beef farmer can have a sustainable system.

To maximise beef usage on dairy herds, dairy farmers should aim to breed sufficient amounts of replacements without breeding excess heifers. Herds with good fertility should look at using sexed semen to breed replacements, which will allow for greater usage of high-value beef bulls. Beef bulls are usually used at the end of the breeding season. Dairy farmers should also consider using beef bulls earlier in the breeding season on low genetic merit cows (i.e poorly ranked on the EBI), poorly performing cows and problem cows.

There is also the potential to use beef bulls on cows cycling prior to the target breeding season start date. This creates the opportunity to use beef bulls with longer gestation, increasing the number of cows calving earlier in the calving season.

The Dairy Beef Index (DBI) is a tool used to identify the most profitable beef bulls on dairy cows, bulls that are easy calving and have short gestation, but also a high beef merit.

Figure 1 shows the composition and the relative emphasis of each trait in the DBI. A validation study showed that, on average, progeny of bulls selected using the DBI compared to bulls selected just for calving traits will, on average, have a similar calving difficulty and gestation length, but superior performance at slaughter (Table 1).

Just like the Economic Breeding Index (EBI), the DBI will be developed further. New traits will be added in future years. Breeding values for age at slaughter have recently been developed and are showing huge potential for breeding animals suitable for slaughter earlier in life.

Bulls in the top 20% for age-at-slaughter breeding values are producing progeny up to a month younger at slaughter compared with progeny from bulls in the bottom 20% for age-at-slaughter. This trait will be vital for reducing greenhouse gas emissions in agriculture.

Other traits envisaged to be included in the DBI in future include calf health, meat quality and environmental traits.

More focus needs to be placed on beef breeding in dairy herds to provide the genetics for a sustainable beef industry, which will also provide a sustainable dairy industry.

Beef selection should be based on the DBI, not just easy calving and short gestation. Further information will be provided at the Moorepark Open Day on the 14-16 September.

Figure 1: The composition and relative emphasis of each trait in the Dairy Beef Index.

Table 1: Average performance of progeny from bulls in the top 20% for calving traits compared to progeny from bulls in the top 20% for the Dairy Beef Index.

Trait	Top 20% for calving traits	Top 20% for Dairy Beef Index
Heifer calving difficulty (%)	3.71	3.12
Cow calving difficulty (%)	0.81	1.62
Gestation length (d)	283.4	283.8
Weight (kg)	301.1	309.7
Conformation (scale 1–15; EUROP)	5.52 (O+)	5.77 (O+)
Fat (scale 1–15; EUROP)	8.54 (3+)	8.34 (3=)
Overall specification (%)	43.78	48.3

moorepark open day

Examining sexed semen

Stephen Butler
Teagasc Research Officer.

It is now possible to almost eliminate low value male dairy calves by using enough sexed semen to generate the required number of replacement dairy heifers, with all other dams inseminated with high-DBI beef bulls.

The resulting calf crop will be composed of dairy heifers (to be retained) and readily saleable beef-cross calves. Sexing Technologies have agreed to establish a sexed semen laboratory in Teagasc Moorepark AGRIC, and will provide a semen sorting service open to all companies in the Irish AI industry starting November 2021.

The presence of a sexed semen lab in Ireland will result in an increase in both the size of the team of bulls and the quality (EBI) of that team available to farmers (i.e more bulls and higher-EBI bulls selected for sorting). This will stimulate a marked increase in the demand for sexed semen.

In addition, it will provide access to a key tool to facilitate genetic gain, as both X-sorted (female offspring) and Y-sorted (male offspring) semen will be potentially available from a wide range of bulls.

In-vitro produced embryos

Mass uptake of sexed semen by Irish dairy farmers will diminish the number of male dairy calf births, and hence a new strategy to generate the next generation of high-EBI bulls for use in AI needs to be developed.

In addition, to achieve genetic gain in DBI, an intensive genetic selection programme will be required.

One option is to use a combination of Assisted Reproductive Technologies (in-vitro produced (IVP) embryos, sex-sorted semen) to intensively select for genetic improvement in elite dairy bulls and beef breed bulls suitable for use in the dairy herd.

During the spring (i.e before the breeding season), elite EBI dairy dams and elite DBI beef dams are scheduled for oocyte collection one day per week.

The harvested oocytes from each donor undergo in-vitro fertilisation (IVF) with semen from different elite sires on different weeks to maximise the diversity of dam-sire combinations. After fertilisation, the IVP embryos are grown in a lab for seven days and are then transferred into surrogate dams that are on day seven of their cycle. Sexed semen can be used to generate IVP embryos, and hence it is possible to pre-select the sex of the IVP embryo offspring.

A trial to evaluate IVP embryos was conducted in spring 2021, and the results will be presented at the open day.

PastureBase Ireland expands userbase

Mícheál O'Leary
Manager, PastureBase Ireland.

Despite 2021 being a difficult year for grass growth and grass quality, PastureBase Ireland (PBI) continues to gain momentum, with more farmers now measuring grass (~3,500).

The frequency of measuring farm covers is also increasing (19.1 covers per farm in 2020 vs 13.8 covers per farm in 2019), which shows that farmers are seeing the benefits of measuring and managing their grass through PBI.

Over the last 12 months, new tools and reports are being developed and added to the application to aid farmers in utilising as much grass as possible on their farms. These include the nitrogen planner, grass report and farm cover report.

An exciting new addition to the application this August was a mapping tool. Farmers can now map their farm and display results (paddock cover, days last grazed, soil fertility etc) as a map rather than in tabular form.

At the Teagasc Moorepark 2021 Open Day, the new Nitrogen Use Efficiency (NUE) calculator will be launched. Farmers will be able to benchmark their NUE and farm gate nitrogen surplus values against the top-performing farms as well as their farming peers.

All farmers are encouraged to sign up to PBI and start measuring their farm covers today.

For more information, please contact your local Teagasc office or email support@pbi.ie.