The Benefits of Dairy-Beef and Crop Production as an Integrated System.

Research project for:

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Executive Summary

For centuries, Irish agriculture has demonstrated resilience and innovation in the face of evolving challenges. In recent decades, technological adoption has driven significant gains in productivity and efficiency. However, the sector now confronts a dual challenge: increasing food production to meet the needs of a growing global population—which surpassed 8 billion in 2023 (Worldometer, 2023)—while also achieving Ireland's legally binding target of a 25% reduction in agricultural greenhouse gas emissions by 2030 (DAFM, 2022).

This report examines the integration of dairy-beef and crop enterprises as a promising approach to developing more sustainable and resilient farming systems. Research and study visits to farms in the UK, Brazil, and Australia revealed benefits spanning the three pillars of sustainability. Farmers reported enhanced nutrient cycling through the application of livestock manures, increased resilience against fertiliser and feed price volatility, and improved labour efficiency resulting from a reduction in seasonal workload fluctuations (Lal, 2004; Dear, 2022; Embrapa, 2020).

While once regarded as traditional, integrated systems are now receiving renewed attention for their potential to reduce emissions while sustaining farm profitability. The findings suggest these systems can improve resource efficiency, support consistent employment, and optimise the use of existing farm infrastructure. As Irish agriculture navigates the complex transition toward sustainability, integrated farming offers a valuable pathway to achieving both environmental and economic goals.

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Foreword

Two recent buzzwords—or even buzz phrases—have been *circular economy* and *food security*. Since the start of the war in Ukraine, global food security has been on a knife edge. A circular economy is seen by many as a way to reduce dependency on other countries and a pathway to self-sufficiency when it comes to food security. Our home farm is now starting to reap the rewards of moving towards a circular/integrated farming model over the last five years.

I'm a beef and crops farmer in Castlemartyr, East Cork, in the south of Ireland. Until 2004, Cork had a very strong sugar beet industry. When the beet factory in Mallow closed, it marked the end of sugar processing in Ireland—and the loss of a reliable income for hundreds of tillage farmers nationally. Like many others, including my father's, our farm moved to 100% combinable crops.

When I returned home in 2015, keen to start farming, I looked at buying dairy-beef calves as a low-cost entry point. That year, I bought my first 27 calves at three weeks of age and reared them to sell at 12 months. This year, farming alongside my father, the farm has doubled in size and now carries around 500 cattle all year round.

In the early years, my focus was mainly on cattle, but as I looked to scale the business, I quickly realised that crops and cattle really complement each other on the same farm. This scholarship has given me the opportunity to see first-hand how the benefits of integration are playing out on farms outside of Ireland and to explore techniques not yet seen here that could play a vital role on our farm in future, particularly as we move towards more conservation-based practices.

We now grow every feed our cattle need. The farm is 100% self-sufficient in feed for finishing 500 cattle annually. We also produce a large share of the nutrients needed to grow those crops, and every year we learn how to make better use of them. This type of farming isn't new to

Ireland, but there are a lot of new methods and approaches that can help make it more sustainable and successful.

GFP DENMARK as we were known as on a ridge in The Mulloon Institute, New South Wales

Acknowledgments

It was a huge honour to be awarded a Nuffield Scholarship and to get the chance to follow in the footsteps of former scholars while also forging my own path. When I interviewed for the scholarship, I mentioned that having looked through the previous roll of honour, I struggled to find anyone who seemed to actually have the time to do it. You could say I fell into that category too, but I'm very lucky to have an unbelievable family and a strong team on the farm.

Firstly, my wife Paula deserves huge thanks for looking after our young family—Harriet (3) and Leo (1)—while I travelled around the world. Paula also played a key role in keeping things running smoothly on the farm in my absence. My father Matt, who is also my farming partner, kept all the balls in the air and kept me up to date on the day-to-day operations while I was away. I owe both Paula and Dad a great deal of gratitude for allowing me the time and space to get the most out of this scholarship. I'm confident that I'll be able to repay that debt through the knowledge, ideas, and opportunities I've gained.

I'd also like to thank Nuffield Ireland Chairman Joe Leonard and Catherine Lascurettes for supporting me along the way, as well as my mentor David Murphy and Karen Brosnan.

When I set off on my first stint of individual travel to the UK in spring 2020, I was blown away by how generous and accommodating everyone I visited was. I think this is largely down to the reputation past scholars have built—as curious and genuine people who don't just take from those who open up their homes and businesses, but who give back just as much, if not more.

Doug Deer of D&P Deer Cattle Finishers was the first person I visited and proved to be a key contact throughout the rest of my UK trip. I'd also like to thank the following people who gave me their time and insights:

- Andrew Laughton, Laughtons of Louth
- Garry Ellis, Lincolnshire
- Simon King, Lincolnshire
- Padraig Blake, Buitelaar
- Mat and Mark Crapper, Lincolnshire
- Dylan Jones, Anglesey
- Ciaran Collins (Teagasc Tillage Specialist)
- Stuart Tate, New South Wales

Objectives

The primary aim of this thesis is to evaluate the benefits of integrating dairy beef production with crop (tillage) production on Irish farms. Specifically, the objectives are to:

1. Assess the sustainability of integration

To determine whether combining dairy beef and tillage enterprises leads to a more sustainable farming system - environmentally, socially, and financially—compared to operating either enterprise in isolation.

2. Evaluate profitability

To analyse whether the integrated system delivers greater overall profitability than stand-alone dairy beef or tillage enterprises.

3. Identify sources of sustainability

To explore the technical interactions and efficiencies between the two systems (e.g., nutrient cycling, labour use, land management) that contribute to enhanced sustainability when operated together.

4. Highlight key synergies and trade-offs

To identify where and how the integration of dairy beef and tillage creates synergies, and to understand any trade-offs involved, particularly in terms of resource use and management complexity.

Introduction

Agriculture in Ireland has always been a sector that adapts and changes with the times. Farmers are constantly looking for ways to improve how they run their businesses, whether that's by being more sustainable, more efficient, or simply more profitable. Traditionally, tillage farms and beef farms have been run as separate operations, each with its own challenges and returns. Often, these enterprises were viewed on their own, judged just by how much money they made or how much work they involved. Tillage was seen as a tough business with tight margins, and beef farming, especially dairy beef, was often seen as risky or not very profitable on its own. Many farmers had to choose one or the other, or even specialise completely, focusing on what seemed to bring the best returns.

But over recent years, more farmers and advisers have started to realise there's real value in putting these enterprises together. Instead of thinking about them as separate businesses, there's growing recognition that integrating tillage and beef production can unlock benefits that improve the whole farm. This approach allows farmers to better use their land, labour, and resources, spread their risk across different markets, and create a more balanced and sustainable farming system.

My own experience is part of this story. I grew up on a tillage farm in Ireland where my father, Matt, ran a successful business focused mainly on growing crops. When I returned home to farm alongside him, I wanted to add something new — so I introduced dairy beef production to complement the cropping side. What started as a small part of the farm quickly grew to be a significant part of the business, now matching cropping in scale and profitability.

From the beginning, I noticed that mixing dairy beef with tillage wasn't just about having another way to make money. The two enterprises worked together in a way that made better use of our land and buildings, spread the workload throughout the year, and helped manage risks that come with changing market prices or weather. For example, crops grown on the farm could be used directly to feed cattle, which meant less reliance on buying in expensive feed. Meanwhile, the cattle helped improve soil health by producing manure and allowing cover crops to be

grazed, which fits well into crop rotations. Labour was spread more evenly across the year, avoiding the highs and lows of just a single enterprise.

All these practical benefits inspired me to explore this topic more deeply. This thesis looks at how integrating dairy beef and tillage production can work on Irish farms, examining both the economic and environmental advantages. It draws on my own experience, visits to farms in Ireland and abroad, and the latest research to show that integrated systems offer a strong way forward for many farmers in Ireland.

Findings

Integrated farming in Ireland has fallen out of popularity in recent years in favor of more efficient single-enterprise operations. Dairy, beef, and tillage farms have worked well for the last twenty years, but with recent challenges, these types of production systems are becoming less efficient.

To meet new environmental targets (Worldometers, 2023), farming will require a different approach. The era of relying on high levels of purchased inputs to ensure high yields is under increasing pressure. Reintroducing animals to tillage land will be essential, as they help improve soil structure and reduce dependence on chemical fertilizers and pesticides.

A move towards integrated farming systems can reduce financial risk, support cash flow, and improve food security at the same time (Jones, D., personal communication, April 2023).

Efficiency and sustainability often pull in opposite directions. Integrated systems can be complex, which may reduce efficiency, but they offer greater long-term sustainability. With good management, however, both efficiency and sustainability can be achieved.

Finally, having more than one enterprise on a farm does increase the overall workload, but it also reduces the seasonality of that work by spreading it more evenly throughout the year (Deer, D., personal communication, August 2022).

Recommendations

On beef farms, it is advisable to reduce stocking rates and replace this with the cultivation of crops grown for forage or sale. The preferred strategy is to prioritise forage production, as this facilitates the return of nutrients to the soil through the application of organic manures, thereby promoting soil health (Jones, D., personal communication, April 2023).

For tillage farms, it is recommended that a proportion of land be removed from arable cropping and sown with grass-clover leys or multispecies swards intended for grazing. The use of cover crops should be maximised, as their strategic grazing under appropriate conditions can provide a cost-effective source of cattle feed while enhancing soil protection.

Incorporation of fodder crops such as maize and beet into the tillage rotation is advised. These crops can be utilised for livestock feed or sold during periods of low cash flow, and additionally contribute to improved cultural control of pests and diseases within the rotation.

Rotational grazing practices, alternating grazing ground with arable land, have been demonstrated to accelerate improvements in soil structure (Collins, C., personal communication, September 2022).

Integrated beef and tillage enterprises should aim for complete self-sufficiency in animal feeds, prioritising the use of homegrown grains and fodder to minimise dependence on purchased feeds (Jones, D., personal communication, April 2023).

The inclusion of red clover leys within arable rotations is recommended to enhance the production of high-protein animal feed while concurrently accelerating soil structural regeneration. Application of organic manures derived from livestock should be focused primarily on arable land to reduce reliance on chemical fertilisers and improve soil quality.

With the adoption of diversified crop rotations and improved soil conditions, the use of reduced tillage or direct drilling methods is encouraged for crop establishment.

Investment decisions should be made with consideration of both enterprises—livestock and cropping—to maximise overall economic returns.

Where additional labour is required, securing supplementary workforce is recommended to manage increased workloads and provide greater operational flexibility for the primary labour unit. All cropping fields should be secured with stock-proof fencing, utilising available grants such as the Targeted Agricultural Modernisation Scheme (TAMS) to support these improvements.

Finally, policy measures should focus on providing incentives to farmers with livestock or cropping enterprises to diversify towards integrated crop and livestock systems, thereby promoting sustainability and resilience within agricultural production.

Case studies

Tillage incentive scheme

In early 2022, concerns regarding food and fodder security in Ireland intensified due to disruptions in global supply chains and anticipated reductions in feed availability linked to the war in Ukraine. In response, the Irish Department of Agriculture, Food and the Marine introduced the Tillage Incentive Scheme to encourage farmers to sow additional eligible tillage crops, thereby reducing dependence on imported animal feed (Tillage Incentive Scheme, 2022).

The scheme offered payments for each additional hectare of arable land cultivated in 2022, conditional on the land being newly converted from grassland and representing an increase over the previous year's tillage area. These eligibility criteria excluded established tillage farmers whose land had not been under grass in 2021. Consequently, uptake was higher among livestock farmers, many of whom used the scheme to grow fodder and combinable crops. The scheme continued into 2023 with the same eligibility requirements, whereby only arable land newly converted from grassland and exceeding the previous year's tillage area qualified for payments.

Grassland farmers intending to participate in the scheme in 2024 may need to adopt a practical strategy of reverting previously cropped land back to grass in 2023, then reconverting it to tillage in 2024 to qualify as 'additional' land. Although the scheme contributed to a 4.5% increase in the national cereal area in 2022, questions remain about its sustainability and impact on domestic feed production.

In the author's assessment, the scheme did not result in a meaningful increase in domestically produced animal feed. To effectively expand tillage areas and support the long-term sustainability of Ireland's arable sector, financial incentives should be more strategically targeted. Priority funding should be directed toward experienced arable farmers capable of producing high-yield crops with minimal inputs, rather than incentivising livestock farmers without a long-term commitment to tillage. The Tillage Incentive Scheme holds significant potential to strengthen the sector, but this can only be realised through careful design that supports its intended beneficiaries rather than inadvertently displacing them.

Doug Dear, D&P Dear Quality Beef Finishers

(Doug Deer, 2023)

In January 2022, the author conducted a series of visits across the United Kingdom to examine beef, arable, and mixed enterprise farming operations. One particularly insightful visit was to Doug Dear of D&P Dear Quality Beef Finishers, located in Selby, North Yorkshire. Doug operates a custom cattle finishing business, managing approximately 3,000 cattle annually. Throughout the 80 to 90-day finishing period, the cattle remain under the ownership of the original farmer, a practice which Doug asserts enhances value by increasing selling power and providing greater efficiency, especially for farmers with smaller herds.

Alongside the finishing operation, Doug manages a 1,500-acre arable enterprise producing oats, barley, maize, wheat, and grass for silage, all integrated into a circular, closed-loop system. All feed used for the cattle is grown within a 5-mile radius on his own land, with the resultant manure subsequently applied back to these fields. This system has eliminated the need for chemical phosphorus (P) or potassium (K) fertilizers for over 20 years, thereby maximising sustainability and efficiency while significantly reducing food miles and reliance on external inputs. Doug emphasizes that transporting cattle to feed is more efficient than repeatedly moving feed to the cattle.

The integration of beef finishing and tillage operations also optimises labour and infrastructure usage. Staff benefit from steady, year-round work; feeding is consistently completed by 9 a.m., allowing time for additional tasks throughout the day. Furthermore, farm buildings maintain continuous utility, alternating between crop storage and housing cattle, thus generating consistent returns on physical assets. Doug Dear’s model exemplifies the practical and environmental advantages achievable through a fully integrated farming system.

Replacing crops with stock

Incorporating Livestock into Crop Farms: Benefits and Practical Considerations

Crop farms are inherently seasonal operations, and many farmers have sought to diversify into multiple production systems to improve cash flow and overall farm resilience. Introducing livestock onto arable farms may initially seem daunting; however, with appropriate planning, this transition can be highly beneficial and manageable. Allocating a portion of farmland to grass/clover or multispecies swards—typically composed of ryegrass, red and white clover, plantain, and chicory—provides valuable grazing opportunities for cattle while promoting sustainable agricultural practices.

Rotating these grass species throughout the farm has a significant positive impact on soil health. The differing rooting depths of grasses and clovers compared to cereal crops enhance soil microbial activity across a broader soil profile. Furthermore, organic manures deposited by grazing animals enrich the soil microbiome and improve soil structure. Enhanced soil structure facilitates reduced tillage and enables the use of direct drilling or no-till techniques for crop establishment, contributing to long-term soil conservation (Collins, 2022).

Integrating red clover into arable rotations supplies high-protein forage for cattle, improves soil structure, and contributes substantial organic nitrogen to subsequent crops such as winter wheat, forage maize, or sugar beet. During housing or finishing periods, organic manures from livestock sheds should be applied strategically to fields where forages have been removed or to the most degraded arable soils, thereby accelerating soil health restoration.

Introducing livestock creates an additional revenue stream that, if well managed, complements the crop production cycle by generating income during periods when arable produce is unavailable. Additionally, feeding home-grown crops to cattle enhances crop value and reduces transportation costs. This diversification spreads financial risk across multiple markets, contributing to greater farm income stability.

Key Benefits of Integrating Livestock into Crop Farms:

- Rotating grass for grazing around arable land significantly enhances soil health.
- Organic manures from grazing animals feed soil microorganisms and improve soil structure.
- Improved soil structure facilitates reduced tillage and supports direct drilling for crop establishment.
- Red clover grown for high-protein forage leaves residual organic nitrogen, benefiting subsequent arable crops.
- Application of organic manures from livestock housing to degraded soils accelerates soil recovery.
- Feeding crops to cattle adds value to farm produce and improves economic resilience.

Red clover

(Nickie Byrne, 2022)

Red clover (RC) incorporated into arable rotations offers numerous agronomic and environmental benefits, particularly in rotations dominated by cereals or where legume presence is limited. RC serves as a valuable break crop due to its distinct characteristics compared to white clover. Notably, red clover grows taller within the sward, making it more suitable for cutting rather than grazing. Its growing point is located higher than that of white clover, necessitating a cutting height above 4 cm to avoid damaging the plant. RC is ideally cultivated as a two- to three-year ley within an arable rotation; beyond this period, productivity declines and weed pressure tends to increase.

One of the key advantages of red clover is its capacity to fix approximately 200 kg nitrogen per hectare annually through biological nitrogen fixation. When fed as silage, animals consuming RC demonstrate significantly improved performance compared to those fed conventional ryegrass silage—typically a 25% increase in productivity, largely attributed to an approximately 20% greater intake of RC silage. Additionally, the senescence of red clover roots contributes substantial quantities of organic nitrogen to the soil, enhancing fertility for subsequent crops.

Careful selection of the succeeding crop is critical to optimize the utilization of residual nitrogen and minimize environmental risks such as nitrogen leaching. Timing of red clover termination must also be managed strategically to maximize nitrogen uptake by the following crop.

Red clover provides a sustainable, high-protein forage source capable of fully substituting imported protein supplements, thereby enhancing farm self-sufficiency. Economically, red clover silage is highly competitive; for instance, per kilogram of protein, RC silage yield of 13.5 tonnes dry matter per hectare costs less than half that of soya protein priced at €600 per tonne. Environmentally, its cultivation reduces the need for synthetic nitrogen fertilisers and contributes to earlier slaughter ages due to improved animal growth rates.

Rotational grazing grass on cropping ground

Introducing grazing leys into arable rotations can substantially improve soil structure and increase soil organic carbon, particularly in fields affected by severe weed infestations (Collins, 2022). For temporary leys, multispecies swards comprising ryegrass, white and red clover, plantain, chicory, and fescue are preferable to simple ryegrass/white clover mixes. The diversity of plant species, each with varying rooting depths, enhances nutrient availability and promotes a wider spectrum of soil microbial communities. The persistence of herbaceous species such as plantain and chicory, which typically last three to four years, makes them ideal for short-term leys.

Grazing livestock contribute organic manures distributed evenly across the land, which stimulates soil biology and improves soil health. These combined factors facilitate enhanced soil carbon sequestration by promoting deeper carbon storage.

In cases of severe weed or soil-borne disease outbreaks in arable fields, a grass break of three to four years can be an effective remediation strategy (Collins, 2022). Different herbicides applicable to grass swards, compared to cereal crops, allow for targeted weed control. Competitive species like chicory suppress arable weeds by overshadowing emerging seedlings. Additionally, regular cutting or topping of annual weeds effectively reduces weed seed banks.

Following termination of the grass ley, minimum soil disturbance establishment techniques should be employed when reseeding arable crops to preserve sequestered carbon and prevent the germination of weed seeds through soil inversion.

Application of Organic Manures on Arable Soils

Applying organic manures to degraded arable soils—those repeatedly tilled and nutrient-depleted—can result in rapid improvements in soil health and fertility. In conventional cropping systems devoid of livestock inputs, nutrient supply relies heavily on synthetic fertilisers. While effective in providing essential nutrients for plant growth, chemical fertilisers often lack components critical to sustaining soil microbial life, and there is evidence suggesting they may adversely affect soil health.

Organic manures, in contrast, provide a broad spectrum of macro- and micronutrients along with beneficial microorganisms not found in synthetic fertilisers. Their application to nutrient-depleted soils represents a sustainable practice, addressing specific soil deficiencies rather than applying unnecessary nutrients to already sufficient soils.

From an economic perspective, organic manures carry high value, particularly when sourced locally, reducing reliance on costly, imported chemical fertilisers. The unprecedented spike in fertiliser prices and supply constraints in 2022 underscored the financial and operational resilience afforded by access to organic nutrient sources, highlighting their role in enhancing farm sustainability.

Replacing Stock with crops

Beef farms in Ireland are often small-scale, part-time operations, frequently established on lower-quality land. In contrast, where more valuable land is available, beef production is typically conducted at a higher intensity and on a larger scale, resulting in greater profitability. Smaller, part-time beef enterprises on poorer-quality land commonly face greater financial challenges.

A key issue faced by single-enterprise farms, including beef-only operations, is market volatility affecting both sales and input costs. Integrating a second enterprise, such as crop production, into a beef farm can diversify income streams and supply essential inputs for the beef enterprise itself, thereby enhancing overall farm resilience.

Stocking rate is the primary driver of profitability in beef production. Allocating some land to crop production can reduce overall stocking rates on the farm, potentially helping to avoid exceeding nitrate derogation limits. High-value crops such as malting barley can be successfully grown on beef farms, contributing to cash flow and providing straw for bedding or feed. Forage crops including maize, grains, and sugar beet offer highly nutritious feed options that reduce reliance on expensive purchased concentrates. This integration is especially critical given the sharp rise in grain prices globally during 2021 and 2022.

Cultivating these crops with the application of organic manures prior to establishment further reduces dependency on synthetic fertilizers. This practice supports improved soil health, decreases exposure to fluctuating fertilizer markets, and enhances the environmental sustainability of the farm system. Red clover, when grown for silage, can fully replace purchased protein sources, contributing to self-sufficiency.

Moreover, crops can be established with minimal soil disturbance—through reduced tillage or direct drilling—when sown into ground previously under grass leys, which tends to be in better condition for crop establishment.

Benefits of Incorporating Crop Production into Beef Farms

- Reduced overall stocking rates help maintain higher stocking densities on grazing platforms while remaining within nitrate derogation limits.

- Home-grown, high-feed-value forages, grains, and sugar beet reduce dependence on purchased concentrates.

- Application of organic manures to cropping land enhances environmental sustainability by reducing chemical fertilizer use.

- Improved soil condition following grass leys allows for reduced tillage or direct drilling during crop establishment.

- Red clover in grass/crop rotations provides a high-protein forage option for cattle.

- Crop production generates additional cash flow through marketable outputs, particularly valuable during tight financial periods.

- Straw from cereal crops supplies a valuable resource for the beef enterprise, reducing external input costs.

Home grown grains forages, beet and straw

Forages such as maize can be effectively grown on beef farms to supply high-quality cattle feed. Maize silage is comparable to first-cut grass silage in terms of quality and price per tonne of dry matter, but it produces significantly higher yields of dry matter per harvest. While it is possible to harvest up to three cuts of grass silage, the quality of the second and third cuts typically declines compared to the first. Therefore, for farms with high demand for consistently high-quality forage and little need for lower-quality feed, maize represents a superior option.

Grains grown either for on-farm feed use or for sale can be produced very economically on land previously under grass, due to improved soil fertility and structure. Cultivating cereals or forage crops for sale not only supports cash flow but also provides a valuable secondary income stream for the farm.

Home-grown forages and cereals enhance the economic sustainability of beef enterprises by reducing reliance on external feed purchases and providing feed at first cost. Many farmers sell crops to their own beef enterprises at market value to maintain clear profitability assessments for each enterprise.

Additionally, the availability of straw from cereal crops is a significant benefit to beef farms, especially in light of the new straw incorporation measure, which is reducing straw availability on the open market (Straw Incorporation Measure Details).

Integrated systems (beef & crops) vs single enterprise (beef or crops)

Farmers who add crops to a beef farm or beef to a crop farm gain several common benefits. One major advantage is the improved utilization of farm buildings. For example, cattle housing can be repurposed for machinery or straw storage when not in use for livestock, and machinery sheds can be adapted to house cattle during periods of high demand for livestock accommodation.

Operating multiple enterprises ensures a steady supply of year-round work, which supports a more stable workforce and allows for better scheduling of time off and holidays. Additionally, cover crops grown after cereal or forage crops can be grazed by cattle, reducing the need for winter forage and providing significant benefits to soil health when grazed under appropriate conditions.

Integrated farming systems are generally more financially sustainable because they diversify income streams across multiple enterprises. Farmers producing both beef and crops can sell into several markets—beef, grains, forages, and straw—so that if one market weakens, others may still perform well, helping to maintain overall farm profitability.

When crops are consumed directly on the farm, farmers benefit from higher margins since no third-party intermediary takes a cut, and transport costs are reduced.

Case Studies

Dylan Jones

(Dylan Jones, 2023)

As part of my Nuffield travel, I visited Dylan Jones, a farmer based in Anglesey, North Wales, who integrates crop farming with finishing cattle and storing lambs.

Dylan's primary goal is to be fully self-sufficient in all inputs required to feed his cattle and sheep. On the farm, they grow barley and wheat specifically for crimping, alongside grass and red clover mixes for silage.

All cattle are finished indoors using the crops grown on the arable side of the farm, while store lambs are fattened on grass over winter. Dylan does not graze any cattle. The sheep are mainly used to graze grass ground during winter, which helps "clean off" the sward to ensure a clean surface for the first cut of silage, while also providing an additional income stream.

Cattle are purchased and, after an induction period, housed indoors for a finishing phase lasting approximately 80 to 110 days. Animals are sold once they meet market specifications and achieve a sufficient profit margin. Dylan sells finished stock to multiple processors. His business plan aims to finish between 1,200 and 1,500 cattle annually, fatten 2,000 store lambs, and cultivate 800 acres of crops.

Winter barley and winter wheat are grown for crimping, harvested at 25-30% moisture content. Dylan explains, "Higher moisture grains add a lot to the system. They are harvested earlier with a higher starch content and allow an earlier entry point for the following grass. Drying the greener straw can be a bit of a challenge, though."

The farm's typical rotation follows winter wheat, winter barley, then a one-year lay of hybrid grass mixed with a high proportion of red clover. All straw produced is used for cattle bedding and returned to the fields as dung. Remarkably, no chemical phosphorus (P) or potassium (K) fertilizers have been applied to the farm for many years.

After planting grass mixes in early July, they are cut at least once during the first autumn, and twice if conditions permit. The sward is then grazed by sheep over winter and cut four times during the first full year. The following autumn, the land is returned to winter wheat, repeating the rotation. Cover crops grown between winter wheat and winter barley contribute to soil improvement and provide fodder for fattening sheep.

While dairy farming is becoming the dominant enterprise in the region—similar to Ireland—Dylan remains committed to his integrated beef and crops system for several reasons.

Once harvest is completed, Dylan knows exactly how much feed he has available for the year and what it has cost him to produce. This allows him to purchase cattle to match his feed supply and use crop production costs as a benchmark to assess the value of animals throughout the year.

Year-round work for staff and consistent cash flow are additional advantages of his system. When feed and fertilizer prices skyrocketed following Russia's invasion of Ukraine, Dylan's system proved its strength. Not relying on open market purchases for fertilizers or feed gives his farm a high degree of financial sustainability.

Environmentally, the farm benefits from improved soil structure due to organic manure use and a more diverse crop rotation. The significantly reduced use of chemical fertilizers is another major environmental benefit.

Dylan takes pride in being able to feed 1,500 cattle and 2,000 sheep annually without importing any supplementary feed, a practice he believes provides a competitive advantage for the future.

Embrapa, Brazil

Embrapa – Integrated Crop-Livestock-Forest Systems

While it is challenging to directly compare agricultural systems in Brazil to those in Ireland, my visit to the Brazilian agricultural research facility Embrapa provided valuable insights into integrated crop and livestock systems.

As cropping intensified in Brazil during the 1980s, it became clear that improved soil management was essential. The widespread adoption of no-till crop establishment marked a

significant step forward in protecting soil health. However, further innovation was needed to maintain sustainable production.

Since then, integrated crop and livestock systems have grown into a major agricultural production method in Brazil, currently covering over 10.1 million hectares.

The system practiced involves under-sowing a maize (corn) crop with Brachiaria grass between the rows. Once the maize is harvested, sunlight reaches the Brachiaria grass, allowing it to grow up to six feet tall. Cattle are then grazed on this grass for about four months.

Unlike intensive grazing systems in Ireland, the grazing in Brazil is more extensive. After the cattle are removed, a thick mat of mulch and organic manure remains on the field. This mulch layer adds nutrients, organic matter, and soil cover, which helps protect the soil from wind erosion.

The positive impact of this integrated system has been particularly evident in Brazil's Cerrado region—the country's primary agricultural area—where it has contributed significantly to sustainable production and soil conservation.


INTEGRATED
CROP-LIVESTOCK-FORESTRY
SYSTEMS
Team:
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Karina Pulrolnik
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Robélio Leandro Marchão
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Embrapa 50
BRASIL

Stuart Tate New South Wales, Australia
(Stuart Tate 2023)

Stuart Tate, New South Wales, Australia

(Stuart Tate 2023)

Stuart Tate farms in New South Wales, Australia, alongside his father, John. In 2015, Stuart completed a Nuffield scholarship focused on "integrated crops and beef farming," aiming to develop a system of growing crops year-round to feed his cattle outdoors.

They grow a variety of crops, with winter wheat and fava beans as the main arable crops. Forages include both temporary and longer-term grass mixes, combining perennial and Italian ryegrass with chicory, plantain, white clover, red clover, and lucerne in different blends. On land suitable for cropping, grass lays typically last 1 to 2 years, primarily for grazing. Minimal silage or hay is made since cattle graze outdoors year-round. Less arable land is seeded with longer-term perennial ryegrass and clover mixtures to maintain continuous feed supply.

Similar to integrated systems observed in Brazil and the UK, a grass crop is sown immediately after cash crop harvest and can be grazed within eight weeks. Winter wheat has occasionally been grazed in autumn to supplement feed when grass is scarce. However, wet weather risks damaging the crop, affecting profitability. Dry cows, once weaned, graze stubbles left after harvest or regrowth, suitable for their lower maintenance feed requirements without risking overfeeding.

A key insight from Stuart's farm is the extensive fencing of cropping fields, enabling rotation grazing for short periods. This approach prevents cattle from overgrazing a single field and maximizes feed utilization from temporary pastures.

The climate, with approximately 950 mm of annual rainfall, shares some similarities with Ireland's drier regions. Soil and animal health on the farm are excellent, supported by reduced chemical fertilizer use—a benefit of integrating crops and livestock in the same rotation.

Stuart giving part of our group a rundown on his farm during one of the coldest spells of weather in new south wales in recent years -1c

Conclusion

Integrated farming systems have been part of Irish agriculture for many years. Traditionally, farms in Ireland were often mixed, combining livestock and crops in different ways to support each other. However, over recent decades, there has been a shift towards more specialised, single enterprise farms — farms that focus mostly on either tillage or livestock. This was driven by a desire to be more efficient, simpler to manage, and more profitable. For a long time, these single enterprise systems worked well and helped Irish agriculture become more competitive on the world stage.

But now, we are starting to see some of the downsides of this move away from integration. Relying on just one enterprise can make farms more vulnerable to problems — whether that's fluctuating market prices, rising input costs, or changing environmental regulations. Many farms are also feeling pressure from labour shortages, rising costs, and the urgent need to reduce their environmental footprint. These challenges mean that farmers need to think differently about how they run their businesses if they want to stay profitable and sustainable in the long term.

Integrated systems can help with these challenges in several ways. Environmentally, they improve soil health by allowing more diverse rotations, using organic fertilizers like manure, and reducing the need for chemical fertilizers. Healthy soils are key to keeping crops productive and resilient to weather extremes. Financially, having both crops and livestock means farmers are selling into multiple markets — so if one market is weak, the other might be strong, helping to balance income and reduce risk. Integrated systems also lower reliance on bought-in feed and fertilizers, which can save money and protect the farm against price shocks.

Labour is another important factor. Although it might seem counterintuitive, integrated farms actually help solve the labour problem by providing steadier, year-round work. Unlike single enterprise farms that can be very busy during short periods and quiet the rest of the year, integrated farms spread tasks and work throughout the seasons. This helps keep staff employed full-time, which improves their job satisfaction and retention. It also allows for better planning of

holidays and time off — something that is becoming more important for the wellbeing of farm workers and families.

Looking ahead, integrated crops and beef farming could be a key part of Ireland's farming future. While it may seem like a step back to some, it actually offers a way forward — combining the strengths of both enterprises to create farms that are more profitable, more sustainable, and better able to handle the challenges ahead. Farms that adopt this approach will be better placed to adapt to environmental changes, manage risks, and provide meaningful, steady work for their people.

In conclusion, integrated systems are not just a traditional way of farming — they are a smart, practical, and proven strategy for the future of Irish agriculture. Bringing together tillage and dairy beef production can create a farming business that is stronger, more resilient, and more sustainable for generations to come.

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