biomass connect

CASE STUDY BOOKLET

Grower Walter Simon's Miscanthus Success Story

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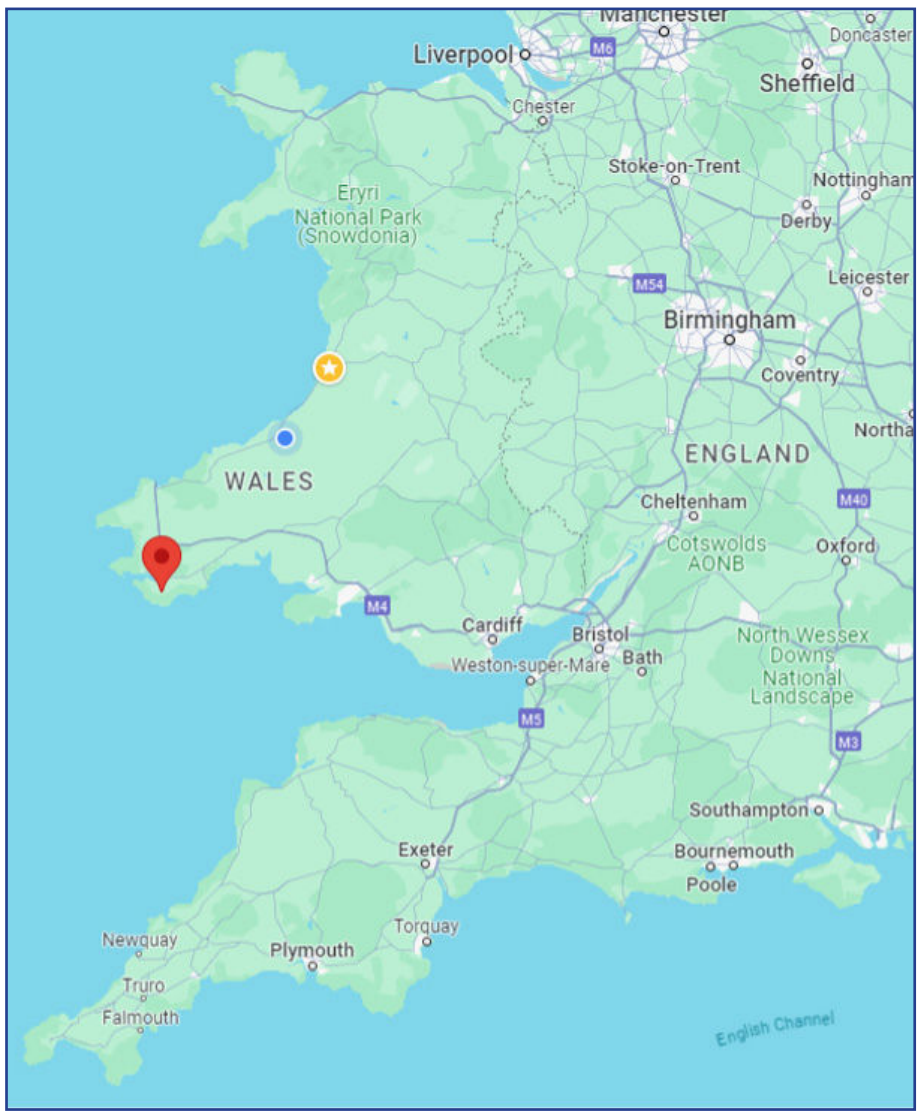
Summary

Walter Simon, a farmer in south Pembrokeshire, has successfully grown Miscanthus on 4 ha of ALC grade 3b land for the last 17 years. The Miscanthus was initially intended for biomass fuel but is now used as bedding for his neighbour's dairy cows. For the dairy farmer this switch to a Miscanthus base-layer proved superior for cow welfare and environmental sustainability, offering a viable alternative to wood chip and straw. Despite challenges with yield, potentially due to soil compaction, the crop's economic viability remains strong with a gross margin comparison favouring Miscanthus over traditional crops like winter barley on similar quality land.

Background

As part of a 140-ha mixed farming enterprise in south Pembrokeshire, Walter Simon has been growing 4 ha of Miscanthus for the last 17 years.



The parcel of land that Walter chose for the crop was unsuitable for arable and root cropping and was in permanent pasture. The soil is a slightly acid loam and although it is generally free draining, the bottom section of this particular field is poorly drained.

Walter was encouraged to plant Miscanthus after being contacted by the Pembrokeshire Machinery Ring in 2007 as part of a plan to supply the newly established Bluestone holiday resort, where it was to be used in their biomass heating plant for the leisure facilities.

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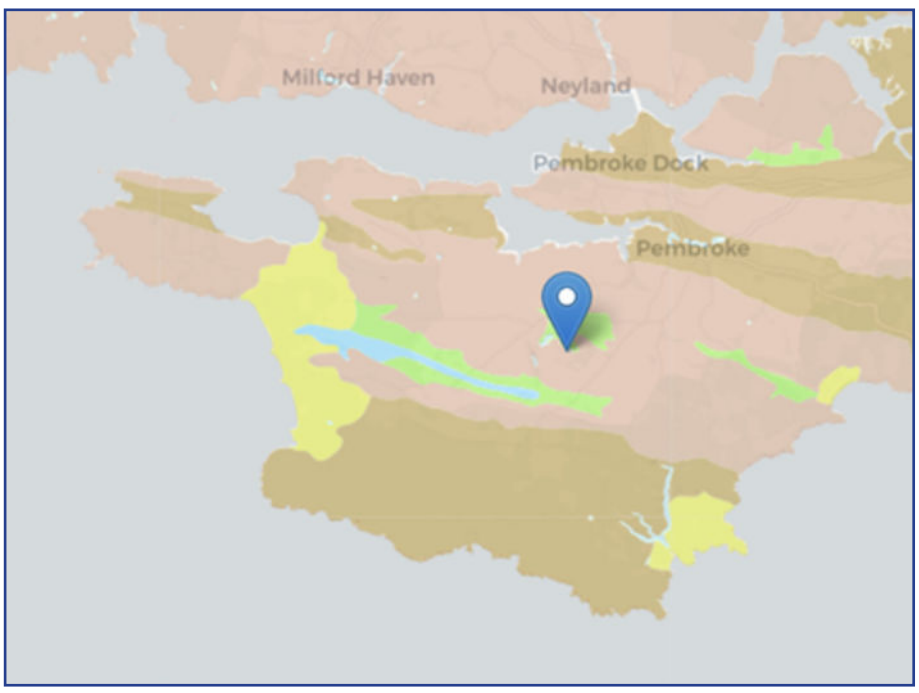

Navigating the harvest

Walter initially faced challenges with harvesting. To supply bales for Bluestone, the crop was first mown, and then left to dry for several weeks before baling. This proved challenging as it required a weather-dependent drying period during February and March and doubled farm traffic on the fields during some of the wettest months, raising concerns for Walter over soil damage.

After some informal discussions with his neighbour, Chris James, the pair came up with a transformative solution. Chris, a spring calving dairy farmer, sought an alternative bedding material for his outdoor corrals (a hard-core pad with drainage for out-wintering cows) due to concerns with woodchip sourcing and environmental impact.

By working together, Walter and Chris changed their farming practices by repurposing Walter's Miscanthus crop as bedding material for Chris's dairy cows.

Harvesting now takes place in a single pass during a dry weather spell in Jan/Feb, using a standard Kemper type maize header and forage harvester. This makes use of a local contractor at a time when forage harvest work is quiet. It also coincides with Chris's need for bedding during his calving period.

This harvest system helps to minimize soil compaction by reducing the amount of travel on the field, but still occurs after the crop has senesced (died back) and most of the leaves and surrounding stem sheath has been shed.

Walter understands the importance of waiting for senescence. Leaves and leaf sheaths are generally wetter components of the biomass that are lost during senescence, helping ensure a drier harvest. They also contain higher levels of nutrients than stem material, meaning that the yield quality[1] of the harvested biomass is improved by their loss and the nutrients they contain are returned to the soil when they remain on the ground, thus promoting sustainability. The shed leaves and leaf sheaths also provide organic matter input for the soil, even equivalent to those provided by FYM[2].

A Sustainable Cycle: From Miscanthus Field to corral to grasslands.

During harvest, the crop is chopped and blown straight into trailers to be hauled the approximately 7 miles to the dairy farm where it is tipped straight onto an outdoor pad. The bedding is then spread and compacted to a depth of 20-30 cm to allow the dissipation of dung and urine. Surplus Miscanthus is tipped on to a concrete pad close by ready to use

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as a top up during the calving period.

According to Chris James's long-term observations, the Miscanthus chip in outdoor corrals performs well on all counts, proving favourable to the wood chip alternatives. The outdoor area under the pad is very well drained into the slurry store, stopping the build-up of moisture. The Miscanthus is structurally strong and sufficiently inert to last the nine-week calving period, but Chris does replace or top-up in the high traffic areas and during higher rainfall periods.

After calving, the material is left in place over the summer to wick rainfall and help reduce water going into the slurry pit. It is then spread onto ground that is to be ploughed and reseeded for grassland. Chris says that because it is chopped, it spreads easily and breaks down well, unlike wood chips.

Cow Welfare

Chris states that, with regards to welfare, comfort, and lameness, Miscanthus bedding is brilliant if the management is correct. The pad is stocked to allow 10 sq m per cow, accommodating approximately 70 cows at any one time. "When given a choice [between Miscanthus bedding and cubicles], the Miscanthus

Leaf material left at the base of the stubble following forage harvesting, important for biomass quality and sustainability.

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pad is always the cow's first choice".

At calving the cows can lie flat and then recover comfortably post calving when they are at their most vulnerable.

Chris states that Miscanthus doesn't seem to be the fertile breeding ground for pathogens that straw beds are. In the past, environmental mastitis had been a problem with the outdoor cubicles, but there appear to be no issues with the pads with Miscanthus.

Several studies have shown that Miscanthus is comparable to other bedding material for dairy cows in terms of its physical[3] and biological[4] properties, and it can help to reduce costs[5] because farmers can grow it themselves, thus building self-sufficiency.

Crop yield

As with all farm enterprises the ability to measure, monitor, and manage are key principles to assess economic viability. The Miscanthus crop at West Orielton farm was planted in the spring of 2007 and since the first harvest in 2009 Walter has recorded the yields. Fresh weight harvest data shown in the chart below indicate a 16-year yield average of approximately 22 t/ha (see note below on yields and moisture content).

Walter wonders now whether crop yield

Chopped Miscanthus material in the corral

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Field damage can be seen in the wetter part of the field (left) compared to the drier areas. This damage may be negatively affecting yield.

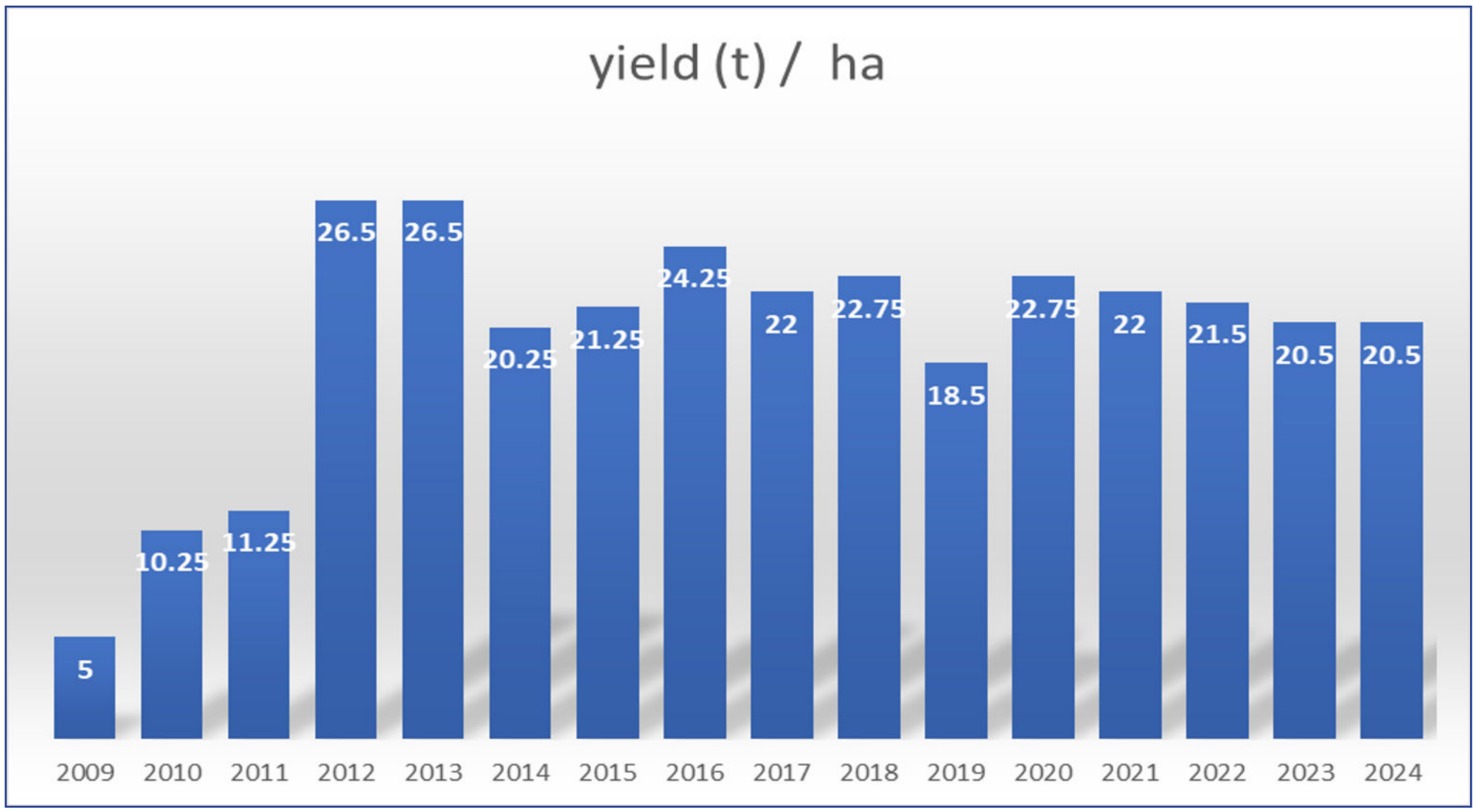
may be declining, and if this may be due to damage caused to the rhizome mat and soil compaction when conditions are wet at harvest or if the mature crop has naturally reached a plateau in yield[6].

Miscanthus has a long growing period compared to that of a cereal crop, this means that short-lived variations in the season, such as low or high rainfall, will have comparatively less effect on annual yield. However, prolonged spells of adverse weather (e.g. drought and flooding, such as have been experienced in the UK for several years) will affect yield.

It is therefore unclear at this stage whether remediation or a better growing season is needed to try and restore Walter's Miscanthus crop yield levels, or whether the crop has reached a mature yield plateau.

The dramatic increase in yield seen between harvests in 2011 and 2012 may have been partly due to crop maturity but also to the change in harvest method: from 2009 to 2011 mowing and baling took place in Feb/March when some drying will have taken place, however the forage harvester method (post 2011) is conducted late Jan/early Feb with the crop likely harvested at a higher moisture content. This slightly earlier harvest may also result in more stem biomass being retained, as upper stem parts can break off during harsher winter weather.

Walter has occasionally applied slurry and compound fertiliser, but none recently, and



Fresh weight yields from West Orielton farm (harvest method changed in 2012).

he felt these applications appeared to have little benefit. He also noted that there had been no significant ingress of weeds or noticeable pests requiring chemical control.

The economic viability of Miscanthus

The gross margin below is calculated based on the harvest from the 2023 growing season (harvested 2024) with a fresh weight yield of 82 tonnes in total from the 4-ha site, selling for £45/tonne, and costing around £700 to harvest and deliver to the dairy site. A gross margin of £748/ha/yr compares to a Welsh winter barley gross margin of £730/ha (FBS Farm Business Benchmarking).

As barley is usually grown on better quality land, the Miscanthus compares favourably when using poorer quality land (Agricultural Land Classification 3b), especially areas where use is restricted by impeded drainage.

Walters' Gross margin

Enterprise output	Harvest total	Per ha
Miscanthus	£3,690	£923
Enterprise cost		
Harvest and haulage	£700	£175
Gross margin	**£2,990**	**£748**

Chris's Comparison of Miscanthus and wood chip as bedding for outdoor corals

Material	Price / tonne
Miscanthus	£45 including delivery
Softwood chip	£55 plus delivery (price ex Ceredigion sawmill)

*Prices are not including VAT

It is also important to consider time invested

in crop management: Walter states that he spends no more than 4 hours a year with the crop.

Establishment costs 2024

Based on figures from the two main providers of planting stock in the UK, rhizome supply and planter hire costs range from £2,100 - £2,500 per ha, which will vary depending on location and total scale of the area planted. After care of the crop for the first year is important for good establishment. This cost is approximately £138/ha for the first two years.

Labour for planting is usually supplied by the management of the site to be planted. Land preparation is additional.

Going Forward

Looking ahead, Walter is keen to find out about some of the wider environmental impacts of Miscanthus cultivation and is looking forward to getting results from soil sampling conducted as part of a project called Perennial Biomass Crops for Greenhouse Gas Removal (https://pbc4ggr.org.uk). The soil samples will help identify the potential of perennial biomass crops, such as Miscanthus, for their contribution to building soil organic carbon content.

Walter also continues to explore avenues for optimisation by considering factors potentially contributing to yield reduction.

Walter concludes that Miscanthus is a great opportunity for people in Wales as the kit to harvest is readily available locally, it is simple to grow and store, and it is cheaper and more sustainable than haulage of straw from England.

Further information regarding technical aspects of Miscanthus agronomy and its suitability for bedding can be found at biomassconnect.org, with best practice guidelines on growing Miscanthus and a cost calculator tool available using a web app such as www.envirocrops.com.

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