Sustainable cropping underpins green energy production

For Devon farmer Stuart Cole, growing feedstock for a green energy anaerobic digester needs to be part of an integrated and sustainable rotational cropping system, just as any other progressive farming operation.

Of the 406 hectares farmed at Menchine Farm, near Tiverton, around half is used to grow a combination of maize, wholecrop oats, Italian ryegrass and beet for the 1.3 megawatt AD plant, with these used alongside poultry litter from two free range broiler units.

Digestate from the plant is spread on the Italian ryegrass leys and is also a primary source of nutrition for the maize. It is also sold off the farm, often in a favourable trading arrangement with neighbours that are growing additional feedstock for the unit.

"Some of the energy produced goes into the poultry units but the vast majority is exported to the grid," says Stuart. "We're a renewable energy producer and it is important to us to be doing this as sustainably as possible. Maize is the most digestible feedstock, and we could run the plant on that alone, but we don't want to be reliant on one crop. We also want a cropping rotation that is looking after soil health and is environmentally responsible."

The plant has been operational since 2015 and the search for the optimum balance of feedstocks is on-going, including trials on the best way to grow maize. Currently, of the 80ha allocated for maize, around 30ha is grown under film.

"We've grown maize previously for local dairy farmers," adds Stuart, "so it's a crop we're reasonably confident with, but some of our land is marginal and it's essential that we have the yields we need to create continuity of supply for the AD plant.

"We've grown a proportion of our maize under film using the Samco system in recent years, with the aim of increasing yields and also achieving an earlier harvest to allow us to establish a winter cereal successfully."

The 2019 harvest at Menchine Farm provided a stark comparison, with maize grown under film on north facing marginal land up to 195 metres being harvested a full six weeks earlier than maize grown on more favourable land in the open. This has allowed a good proportion of the winter oats to be drilled after maize grown under film, whereas the crops grown in the open were not harvested until the end of October.

"With the conditions we had this autumn, we would not have been able to harvest around 25% of the land if all maize had been grown in the open, as it would have been too wet to travel. We'd also have trashed a lot of the land with late harvesting.

Stuart Cole needs a reliable source of feedstocks for his AD plant and growing maize under film provides part of the solution

"I am very glad we used film where we did this year. I will be continuing with maize under film but will also still grow some in the open so we can continue to evaluate it over a number of seasons."

In the final analysis, maize grown on marginal land under film at Menchine Farm averaged 41 tonnes/ha freshweight, over 10 tonnes/ha more than was achieved from crops grown in the open, which will more than cover the extra cost of the system, according to ProCam's Emma Dennis, one of the farm's agronomists.

"There is additional cost in growing maize under film, but with Samco maize – which is a full system approach – the return on investment is significant," she says.

"We have a ten point plan for anyone wanting to grow maize under film, which includes everything from correct soil management and site selection through to working with fully trained operatives. It's a tailored approach, with key decisions such as the type of oxo-biodegradable film and variety selection depending on the farm's situation and desired outcome.

"Variety choice is particularly important, and we've found through an extensive programme of trials over many years that only certain varieties are suited to the conditions created by film. We make recommendations based on our trials and the particular conditions and requirements of each individual farm."

Emma points to areas such as nutrient use efficiency as additional benefits of growing maize under film, which add to the extra yield and earlier harvest that are the initial attractions.

ProCam's Emma Dennis recommends a ten-point plan as part of a holistic approach to growing maize under film using the Samco system

"The warmer soils created by the film make phosphates more available, removing the need for DAP down the spout, for example, and farmers will see more efficient use of slurry and digestate. With more focus on the environmental consequences of different farming systems, maize grown under film will have advantages in terms of nutrient use efficiency and soil health, with earlier harvests more likely to allow the establishment of a following crop, thereby reducing soil erosion during the winter months."

In addition to the field scale comparisons between maize grown under film or in the open, Menchine Farm is also hosting a series of strip trials with plant breeder Pioneer.

Simon Preece, who manages the south west PACT trials, agrees that some hybrids are better able to cope with the environment under film and that variety choice is therefore a crucial part of achieving success with the system.

"We've grown a number of our hybrids under the Samco system to see which perform best," he reports, "and some have been grown both under film and in the open. One direct comparison involved the early maturing hybrid P7326, which is one we would consider to be suited to growing under film. In the 2019 trials, we saw a 28% increase in both dry matter yield and predicted methane yield per hectare when the variety was grown under film.

"This clearly shows the advantage of the system in a year when seasonal temperatures were fairly close to the long term averages."

Simon Preece adds that whilst the extra yield from the current maize crop is important, the wider impact of more timely autumn drilling and better soil health should also be a major consideration.

That's certainly a factor for Stuart Cole, who first and foremost wants a reliable feedstock, but is also focussed on the long term sustainability of his system.

Pioneer Accurate Crop Testing System (PACTS) strip trials at Menchine Farm, showing maize hybrid P7326 grown under film (left) and in the open on 24th June 2019

Feedstock breakdown (Menchine Farm)

Maize	-25%
Wholecrop	-25%
Zero-grazed grass or beet	-25%
Poultry litter	-25%