Research Theme: Environment

Case Study

Clover Innovation Supports Sustainable Livestock Farming in Wales

RESEARCHERS

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THE OVERVIEW

Research and breeding programmes at Aberystwyth University's Institute of Biological, Environmental & Rural Sciences (IBERS), have successfully generated highly persistent clover varieties. Increasing the use of these varieties in grassland agriculture provides significant economic and environmental benefits. AberLasting; the first commercial white clover variety was developed by researchers at IBERS, and was added to the UK National List in 2016. Persistent red clover varieties have also been developed, notably AberClaret, which accounts for 15% of red clover seed sales in the UK.

THE CHALLENGE

White and red clover are two of the most important forage legumes for temperate sustainable livestock production systems. They offer natural nitrogen fixation, reducing the need for industrial nitrogen fertilizer. They are superior to grasses in nutritional value, with a crude protein (CP) content of 18-19%, and they improve soil structure and fertility.

However, greater use in the UK has been limited by its lack of persistence in swards (the grassy surface of land). Increasing persistency therefore, particularly in mixtures with grasses is an important breeding target.

THE SOLUTION

Innovation has been central to IBERS's breeding programmes, supported by BBSRC, the Welsh Government and Innovate UK, and funded significantly by our strategic partner Germinal Holdings Ltd. (the largest UK owned forage seed wholesale company).

ABERLASTING

A major breakthrough was made in the development of the variety AberLasting, the first white clover-Caucasian clover hybrid. This variety, combining the best qualities of both parent species, is able to persist in environments that are too harsh for conventional clovers, partly due to a greater root biomass at depth. AberLasting is in commercial production, and is now being sold in four continents.

ABERCLARET

Historically, some producers have avoided red clover, due to a tendency for yields to drop off over time. To solve that problem, IBERS scientists developed varieties which focused on better persistence and improved yields, notably AberClaret, which produces high yields in the third and fourth harvest years.

AberClaret gave the highest dry matter yield in mixed swards in Year 4 (61%) in an experiment comparing 12 red clover varieties. This resulted in greater CP yields on an area basis, highlighting the importance of red clover persistence to the feeding value of grass/red clover swards.

THE IMPACT

ECONOMIC AND COMMERCIAL IMPACT

Seed of the IBERS bred clover varieties is marketed through a strategic alliance between IBERS and Germinal Holdings Ltd. 40 tonnes of seed of AberLasting was produced in New Zealand in 2017, with a further 40 tonnes produced in 2019. Demand is increasing as the variety is very popular in New Zealand, and seed is returned to the UK for inclusion in Germinal mixtures. Trials are taking place in Japan, France and other countries. It is anticipated that seed of this and other varieties developed from this germplasm will be sold in many European countries.

Seed sales of AberClaret represented approximately 15% of the UK market in 2017. Further expansion continues, both domestically and in international markets including Switzerland, New Zealand, Australia and Canada.

The England and Wales Recommended List shows that among diploid varieties, AberClaret had the second highest yield in the second and third harvest years. Its high biomass yield, even in the fourth year, increases the nutritional quality of the silage and persistence for the duration of many medium-term leys. At the farm level this equals a saving of £700 on imported soybean meal. Assuming a price of £350 per tonne, this is worth up to £7,000,000 for 10,000 tonnes. Growth rates of 1.3kg/head/day (growing ration) and 1.5kg/head/day (finishing) in beef cattle are being achieved, with no oil seed rape meal or soya required when red clover silage is available.

SOCIETAL AND ENVIRONMENTAL BENEFIT

White clover fixes approximately 150kg N/ha/yr (Nitrogen per hectare per year), some of which is utilised by the companion grass, providing an economic and environmental benefit to the farmer and society by reducing the need to apply mineral nitrogen fertiliser. White clover breeding programmes have focused on ensuring that the proportion of white clover in a sward is sufficiently persistent to be maintained at an optimal 30% in mixtures with grass. Such mixtures require 300 to 400kg N/ha/yr less Nitrogen fertiliser compared to grass monocultures to achieve the same yield. This reduction in fertiliser application reduces CO_2 emissions by approximately 1t/ha/yr, and provide a saving of £70 per ha for the farmer, assuming a cost of approximately £200 per tonne of Nitrogen. Furthermore, application of nitrogenous fertilisers accounts for the majority of N_2O emissions. For every 100kg of fertiliser Nitrogen added to the soil, on average 1kg of Nitrogen is emitted as N_2O, which is equivalent to approximately 600kg of CO_2.

Red clover contains high levels of the enzyme polyphenol oxidase which has beneficial effects on nitrogen utilisation in ruminants. It is also an excellent break crop allowing soil fertility to build up, and reducing weed problems, particularly blackgrass in cereal crops.

In addition to Nitrogen fixation, soil fertility and structure, clovers reduce the need for reseeding as they remain productive for 5 or 6 years, even under heavy abiotic stress. They continue to grow during drought periods (in contrast to grass) and provide more tangible benefits to the environment in terms of food and habitat for insect pollinators, thus maintaining the biodiversity in grasslands.