Project number: 4755
Funding source: Teagasc and the seed industry
Date: Oct 2012
Project dates: Jan 2001 – Dec 2008

Breeding improved varieties of white clover

Key external stakeholders:
Grassland farmers, seed industry, advisors, agricultural consultants and researchers.

Practical implications for stakeholders:
The research programme focussed on breeding improved varieties of white clover for Irish farm systems. The primary traits for improvement were annual clover yield, seasonal yield distribution and persistency. Key results were:

- Three new white clover varieties, Chieftain (medium leaf size), Galway (small leaf size) and Pirouette (micro leaf size), offering improvements in clover productivity and persistency over existing varieties, were commercialised and released.
- A new market for the white clover variety Susi (medium leaf size) was established in France with the addition of the variety to the French National List.
- Teagasc bred white clover varieties, Chieftain and Avoca, were the highest yielding medium leaf size clover varieties on the 2012 Recommended List of Grass and Clover Varieties for Ireland.
- Four other white clover varieties bred by Teagasc displayed exceptional performance in the Teagasc trials and were submitted to the Department of Agriculture, Food and Marine for consideration for addition to the Recommended List of Grass and Clover Varieties for Ireland.
- Breeding offers a low cost and successful means to improve the productivity and profitability of white clover based swards.

Main results:

The Teagasc bred white clover variety Chieftain (medium leaf size) was added to the Recommended Lists of Grass and Clover Varieties for Ireland, Northern Ireland, Scotland, England and Wales. Chieftain is a large-medium leaf size variety suitable for cattle and sheep grazing, and intensive silage production. Chieftain offers excellent clover yield, total grass and clover yield, and persistency. Chieftain is the highest yielding variety in the medium leaf size group on the Recommended Lists for Ireland and Northern Ireland. The Teagasc bred white clover variety Galway (small leaf size) was added to the Recommended List of Grass and Clover Varieties for England and Wales. Galway is primarily suited for sheep grazing offering significant improvements in spring yield and persistency, and excellent total yields under hard defoliation. The Teagasc bred white clover variety Pirouette (micro leaf size) is a very small leaf size variety used for amenity purposes throughout Europe with the addition of the variety to the German National List. The microclover variety persists well and grows densely under frequent lawn mowing. Pirouette keeps the lawn much greener and healthy without the application of fertilizer nitrogen. Commercial seed of Teagasc bred varieties are produced and distributed worldwide by DLF-Trifolium, Germinal Holdings Ltd and Semental Ltd.

Opportunity / Benefit:

This project offers farmers new improved white clover varieties of greater genetic merit and improved agronomic characteristics that when sown may increase the productivity, profitability and sustainability of Irish farm systems. A commercial agreement between Teagasc and the seed industry ensures the production and availability of seed for farmers.

Collaborating Institutions:

DLF-Trifolium; University of Wisconsin-Madison; DAFM; Agri-Food and Biosciences Institute in Northern Ireland

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1. Project background:

White clover (*Trifolium repens*) is one of the most nutritious species available in grassland/ruminant production systems. In association with grass, this species increases protein, mineral content, intake and nutritional value of the total forage. Because of its nitrogen fixing capacity, white clover has the potential to reduce, or in the case of organic systems, eliminate the need for inorganic nitrogen fertilizer on grassland. Grassland-based animal production is a major part of the Irish agricultural economy and consequently any improvement in this legume has large potential benefit in this sector.

Forage breeding is a technology that harnesses the creative power of selection. It is powerful, precise and predictable. White clover has been subjected to very little formal breeding. Genetic variation within and among populations is still extremely high, showing no signs of decreasing. Breeding offers a low cost means of improving the profitability and productivity of white clover.

The objective of this project was to breed improved varieties of white clover for Irish farm systems. The primary traits for improvement were annual clover yield, seasonal yield distribution and persistency. World-wide propagation and marketing rights on all new varieties were offered to a commercial company ensuring the availability of new varieties to Irish farmers. This project continues, with modifications, the successful commercial white clover breeding programme established at Teagasc, Oak Park, Carlow in the 1960s.

2. Questions addressed by the project:

- Can forage breeding produce improved varieties of white clover?
- What level of genetic improvement in white clover can be achieved with forage breeding?

3. The experimental studies:

The breeding programme was based on (i) recurrent phenotypic selection involving the evaluation of individual plants, (ii) recurrent genotypic selection involving the evaluation of the progeny of different crosses and (iii) the production of synthetic varieties constructed by intercrossing a number of selected genotypes. The main emphasis was on improving variety performance under grazing. Selection was based mainly on clover performance in mixed grass-clover swards. The main traits for improvement were annual and seasonal yield distribution of clover and grass plus clover, and clover persistency. The best varieties were submitted to the official Recommended/National List trials in Ireland, UK and other countries for independent evaluation. World-wide propagation and marketing rights on all new varieties were offered to a commercial company ensuring the availability of new varieties to Irish farmers.

4. Main results:

Fifteen new varieties of white clover were constructed. The best seven varieties were submitted to the official Recommended/National List trials in Ireland, UK and other countries for independent evaluation. Three new varieties, Chieftain, Galway and Pirouette, were found to have greater genetic merit and improved agronomic characteristics over existing commercial varieties and were added to the Recommended/National Lists of Grass and Clover Varieties in Ireland, UK and other countries.

Chieftain (medium leaf size) was awarded Recommended Listing in Ireland, Northern Ireland, Scotland, England and Wales. Chieftain is a large-medium leaf size variety suitable for cattle and sheep grazing, and intensive silage production. Chieftain offers excellent clover yield, total grass and clover yield, and persistency. Chieftain is the highest yielding variety in the medium leaf size group on the 2012 Recommended Lists of Grass and Clover Varieties for Ireland and Northern Ireland. Chieftain had 3% higher total yield of grass and clover than the mean of the medium leaf size group on the 2012 Recommended Lists for Ireland and Northern Ireland.

Galway (small leaf size) was awarded Recommended Listing in England and Wales. Galway is primarily suited for sheep grazing offering significant improvements in spring yield and persistency, and excellent total yields under hard defoliation. Galway had 21% higher spring yield and 13% higher ground cover than the mean of the small leaf size group on the 2011 NIAB (England and Wales) Recommended List of Grass and Clover Varieties.

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Pirouette (micro leaf size) is a very small leaf size variety used for amenity purposes throughout Europe following addition to the German National List. The micro clover variety persists well and grows densely under frequent lawn mowing.

Full variety results from the Ireland Recommended List are available at www.agriculture.gov.ie and the Northern Ireland Recommended List at www.afbini.gov.uk

In conclusion, the Teagasc white clover breeding programme continues to produce new improved varieties of white clover with greater genetic merit and improved agronomic characteristics than existing commercial varieties.

5. Opportunity/Benefit:

This project highlights the benefit of white clover breeding to grassland agriculture and the large improvements in white clover productivity that may be achieved through breeding. This project offers farmers new improved white clover varieties of greater genetic merit and improved agronomic characteristics that when sown may increase the productivity, profitability and sustainability of Irish farm systems. A commercial agreement between Teagasc and the seed industry ensures the production and availability of seed for farmers.

6. Dissemination:

This information has been widely disseminated to grassland farmers via discussion groups, open days, farm walks, popular press and Teagasc publications. It will continue to be disseminated through Teagasc advisors at discussion groups. Full variety results have been published in the Recommended List of Grass and Clover Varieties for Ireland, Northern Ireland, Scotland, England and Wales.

Main publications:

Recommended List of Grass and Clover Varieties for Ireland (DAFM) at www.agriculture.gov.ie
Recommended List of Grass and Clover Varieties for Northern Ireland (AFBI) at www.afbini.gov.uk
Recommended List of Grass and Clover Varieties for England and Wales (NIAB) at www.bspb.co.uk

Popular publications:

Irish Farmers Journal
Farming Independent
Today's Farm

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