Plant Breeding in Irish Agriculture

L.O's 1.1C 1.4B 3.1B 3.3.2F 3.3.2J

Breeding Process

Every seed & every plant is unique → Genetics & performance

Variety Improvement

15 to 20 year process consisting of 3 stages

Stage 1 Breeding (product development) 7 to 10 years → **Stage 2** Independent variety testing (product testing) 5 to 7 years → **Stage 3** Commercialisation (product release) ≥ 2 years

Milestones

1980

Teagasc set up a Breeding Programme at its Crop Research Centre, Oak Park, Co. Carlow in the 1960's tasked with using genetics to improve forage provision on Irish farms. In *1980*, they announced the release of their first perennial ryegrass, a tetraploid variety named ***Greenisle.***
At that time the majority of swards on Irish farms consisted of native grasses. Farmers sought grasses that had good digestibility, leafiness, yield and grasses that were suitable for outdoor grazing. Productivity, palatability and digestibility were the focus. At this time, there was little or no clover sown on Irish farms, Teagasc developed their first white clover variety in 1983, called Aran. The breeding technique used by Teagasc to develop these varieties was known as genotypic recurrent selection through field trials.
The plant breeders from Oak Park, identified the best plants through field evaluations. This involved firstly, selection, where a large number of selected grasses are crossed to produce enough seeds to allow the field trials to progress and secondly, evaluation, where the grasses are grown and evaluated over a number of years. The best families are identified and used as parent plants for the next generation.

This process is known as genotypic recurrent selection which results in each new generation having an improved performance. The drawbacks are it is a long process; a single round of selection through field trials takes seven years from seed to seed. A further limitation is that during the evaluation stage it is difficult to actually measure the effectiveness of traits being improved such as disease resistance.
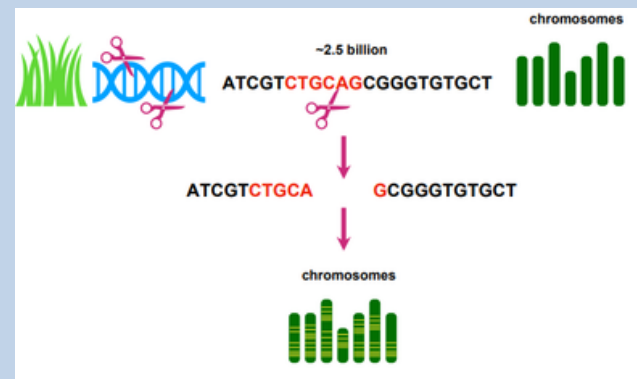(Adapted from Teagasc Research Insights, Webinar 18 May 2021Role of grass breeding and evaluation to increase the sustainability of pasture-based systems).

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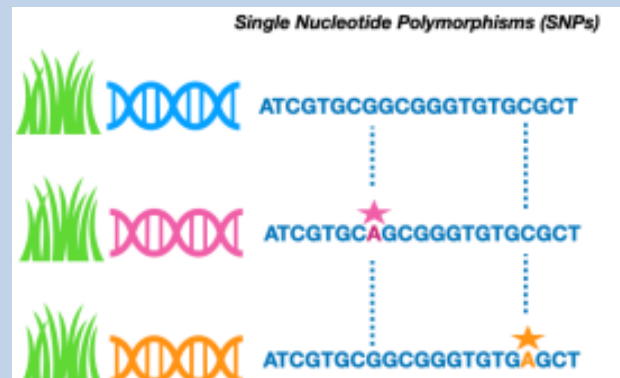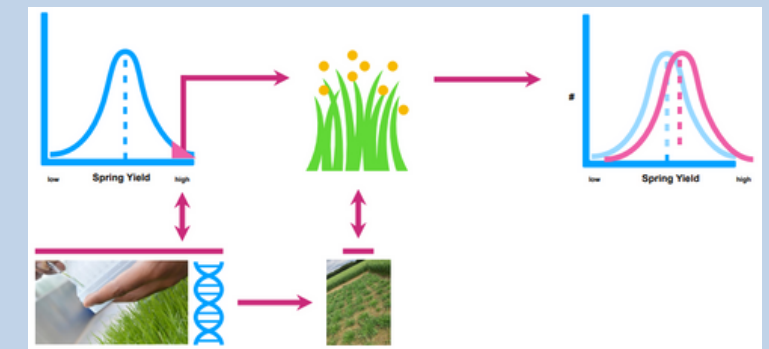
Step1. SNP's are identified within a grass of interest for spring yield (desired trait)

Step 2. Plants of interest have their DNA profiled in a database

Step 3. Plant 2 has been identified as the grass with superior spring yield

Step 4. Using plant 2 in a breeding programme will increase genetic gain

2017

By **2017**, Teagasc had another first when they released a perennial ryegrass variety, named **Oak Park** which this time had been developed using genomic selection technology. Swards were still monocultures of perennial ryegrass with many farmers also using Italian ryegrass species in some parts of the country. Sought grass traits were good digestibility, leafiness, graze out, grazing resilience and disease resistance. White clover is now commonly sown in grass mixes because of its nitrogen use efficiency and nitrogen fixation qualities.

Advancements in genetics allowed plant breeders to use genomic selection, which is a faster technique than traditional plant breeding and field trials. Now, plant breeders could create DNA profiles of each plant and create a database with the DNA of its reference population. They could then take a plant of interest, analyse its DNA and compare it to reference DNA profiles. This allowed them to identify superior parents much faster and with greater accuracy, reducing the seed to seed period to one year.

(Adapted from Teagasc Research Insights, Webinar 18 May 2021- Role of grass breeding and evaluation to increase the sustainability of pasture-based systems).