

Vegetable genetics and breeding – past present and future.

A commercial perspective



Our Company has Great History



175
YEARS

Yielding results
for UK farmers

175 years in Agriculture 1844



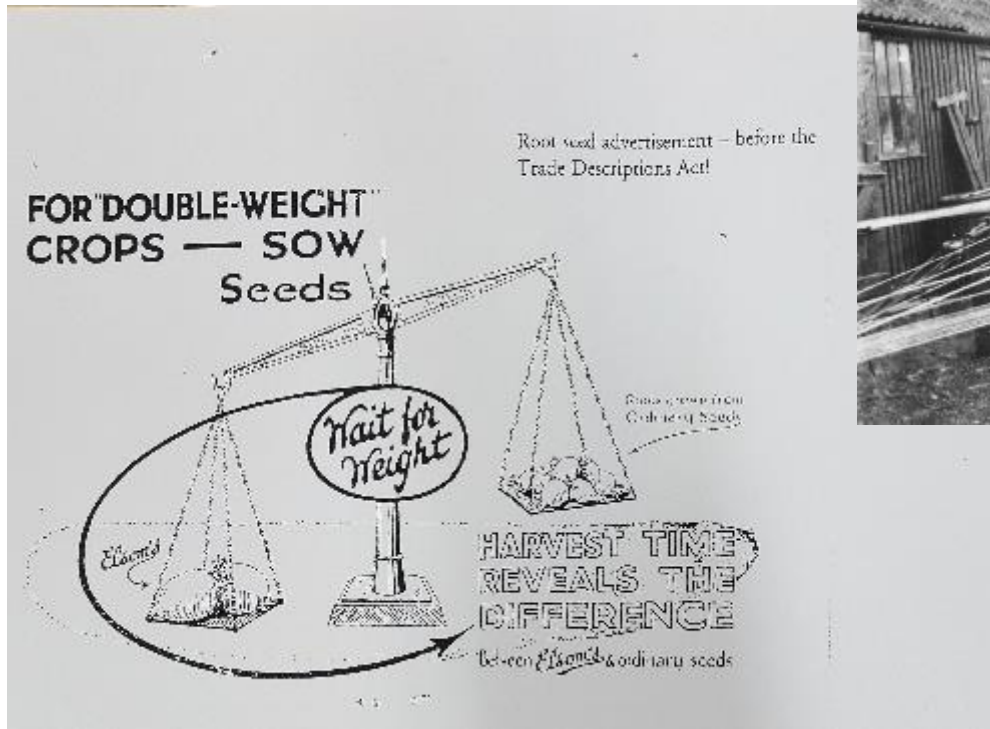
1844



2019

Where it all began - 175 years old

Elsoms started as a company making ropes.



Selling seed came later

What were they selecting for – Not much has changed

+ Yield



+ Durability



+ Disease and Pest resistance



+ Palatability



BUT

- ⊕ With the development of knowledge, research and technology we can do things

BETTER & QUICKER

What is the breeders Art

Observation



Absorbing information over time



Looking for the next winning combination !

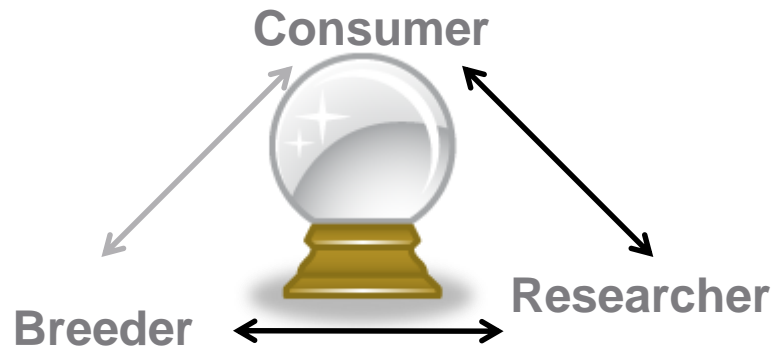
The reality – Hard work! challenging conditions! Commitment for many years!



Breeders are constantly planning for next challenges

What does the future hold?

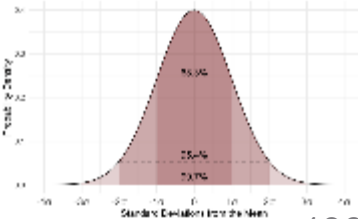
- ⊕ Today's quality in tomorrow's growing environment!
Breeding today for a market and environment in more than 10 years time



How has history of genetic research impacted on Elsom's



1908 - George Harrison Schull



1960's - Bourlaug semi dwarf wheat

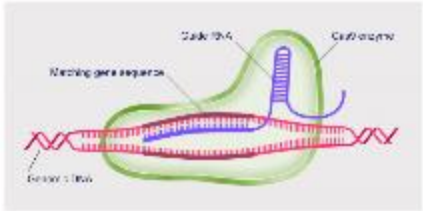


Gene editing

1856 - Mendel

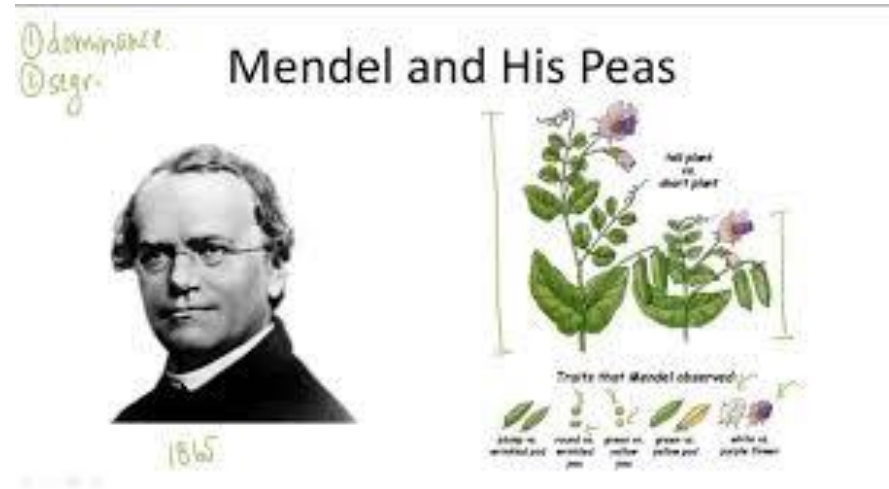
1920's - Statistical development

1990's - GM tomato and Soya



Early Genetics

Mendel's pea plant experiments conducted between 1856 and 1863 established many of the rules of heredity,

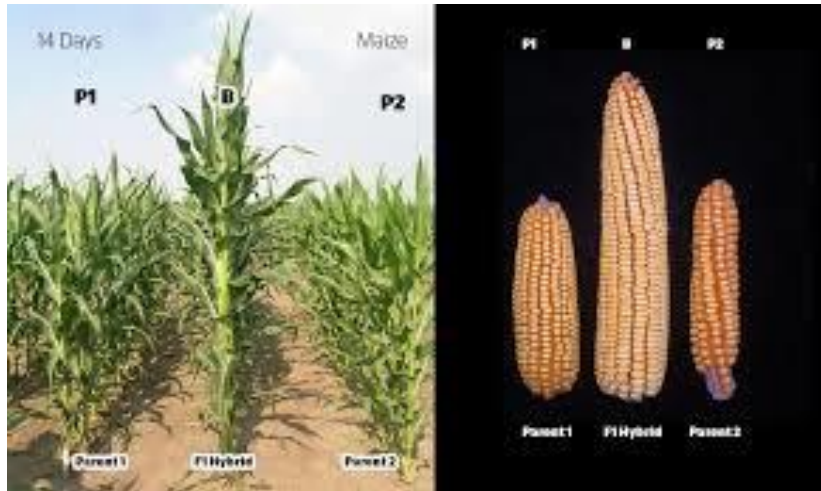


1844 – Isaac Elsom established a rope and twine making business – not selling seed



Heterosis

- ⊕ In 1908 George Harrison Shull described Heterosis or Hybrid vigour



- ⊕ 1885 – Company started to sell seed 1914 – First trial grounds were established

With increasing research and knowledge Elsoms expands business

- + 1919 – NIAB established by Lawrence Weaver
- + 1920s,- statistical methods were developed to analyse gene action
- + 1933 - cytoplasmic male sterility was developed in maize
- + 1920's & 1930's – Elsoms business expanded from flowers to cereals and forage crops, they grew and supplied on contract a PBI variety Yeoman and a French bred variety Bersee.



“It is easy to forget that fifty or sixty years ago much that would now be taken for granted still lay in the future. Cereal seed was simply known as “New” or “Once grown”. There was no field approved scheme and no control over sales except purity and germination” – Elsoms the History 1994

The war effect

In 1942 John Keeling joined the business making many improvements during this period of food shortages

Elsoms was known for its wheat seed and continued producing Bersee throughout the war continually improving the stock.



“The legal situation was unclear but as soon as possible after the war George Elsom contacted Blondeau explained what had happened and voluntarily offered two shillings and sixpence per hundredweight for all the Bersee that Elsoms had sold to date”

Post War – Food production became a government priority

1949 - National Vegetable Research Station (NVRS) was established in response to post-war pressure for food production.

'A second-hand wooden hut was erected in January 1950, with the modest dimensions of 12ft by 15ft to provide office accommodation for the Director, Secretary and shorthand-typist' NVRS First Annual Report.

1945 -The Green Revolution increased crop production in the developing world achieved by the use of artificial fertilizers, pesticides, and high-yield crop varieties.

1960s.- First came the development of hybrid maize, then high-yielding and input-responsive "semi-dwarf wheat" (for which the CIMMYT breeder N.E. Borlaug received the Nobel prize for peace in 1970),

Up to now effort had been in cereal crops but the breeding knowledge and techniques soon became adopted by seed companies to improve vegetable varieties

UK seed companies such as Elsoms and Tozer start breeding programs

- ⊕ Collaborations with other breeding companies and UK researchers resulted in extensive trialling.



Researchers at NVRS the predecessor to Warwick crop centre were at the forefront of all aspects vegetable research. Companies were able to access the knowledge to support their growing breeding programs.

F1 hybrids using self incompatibility and cytoplasmic male sterility were developed in vegetables



Gladiator F1 bred by Tozer seeds selected for disease resistance using CMS



Brussel sprout and Purple Sprouting broccoli from Elsoms using self incompatibility



Tissue Culture and Double Haploid production

- ⊕ The need to speed up the breeding process resulted in the development by researchers of tissue culture techniques and DH production.
- ⊕ In the 1980's Elsoms set up a DH lab and has successfully produced new breeding material which has produced commercially successful varieties,



Genetic Modification

- ⊕ 1994, the Flavour Saviour became the first commercially grown genetically engineered food.
- ⊕ BUT the public response to this technology meant seed companies were unable to adopt GM.
- ⊕ A useful spin off for breeders was Marker Assisted Breeding



Breeding programs using Marker Assisted Selection

- Elsom's have invested a large amount of money in research



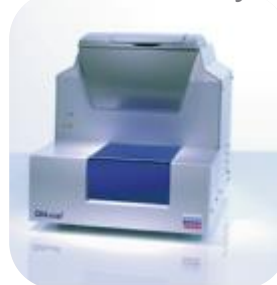
- Allows breeders to identify genes responsible for particular traits

- ⊕ These can be identified in parent lines and their progeny
- ⊕ Can speed up traditional plant breeding methods

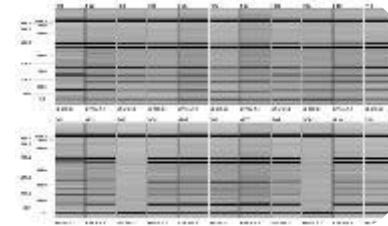
DNA extraction



Genetic analysis



Analysis of results



In the following years companies working with researchers at the crop centre on projects such as those in VeGIN were able to improve the quality of commercial varieties



Addressing problems for UK growers

Elsoms – projects with Warwick crop centre

- ⊕ Valuable long term relationships
- ⊕ Link projects
- ⊕ 3 PhD's in the last 10 years.
- ⊕ 2 Knowledge transfer Partnerships
- ⊕ 2 Innovate UK projects

Innovate UK
Knowledge Transfer Network



Utilising expertise in

- ⊕ Crop pests and disease
- ⊕ Genetic sequence and markers for QTL production
- ⊕ Imaging
- ⊕ Software programming
- ⊕ Genebank accessions and plant Diversity sets



Gene Editing

Scientists aim to develop drought-resistant crops using genetic engineering

Genetically engineered salmon are heading to supermarket shelves despite environmentalists' fears that fish could escape and wreak havoc

Small companies based in the UK and marketing in the EU white tape and weak havoc

Block on GM rice 'has cost millions of lives and led to child blindness'

Scientists call for modernization of EU gene-editing legislation

The Future - New tools, knowledge and resources for proof of gene function

- ⊕ Companies like Elsons can work with researchers at Warwick crop centre using these technologies and resources to support and inform our breeding work.

- Genome sequence
- SNP markers
- Gene editing
- Plant resilience
- Plant disease
- Insect pests
- Storage
- Crop nutrition



- ⊕ Warwick gene bank and the established diversity sets are valuable resources for genetic diversity



Congratulations to Warwick Crop centre on your
70th Anniversary