Vegetable genetics and breeding – past present and future.

A commercial perspective
Our Company has Great History
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
Domestication estimated to date back 9,000 to 11,000 years human farmers selected food plants with particular desirable characteristics and used these as a seed source – Early breeders.
What were they selecting for?

- Yield
- Durability
- Disease and Pest resistance
- Palatability

- Not much has changed
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 Elsoms

1856 - Mendel

1908 - George Harrison Schull

1920's – Statistical development

1960's - Bourlaug semi dwarf wheat

1990's - GM tomato and Soya

Gene editing
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.
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,
1994, the Flavour Savour 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

- Elsoms 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

Utilising expertise in

- Crop pests and disease
- Genetic sequence and markers for QTL production
- Imaging
- Software programming
- Genebank accessions and plant Diversity sets
Scientists aim to develop drought-resistant crops using genetic engineering.
The Future - New tools, knowledge and resources for proof of gene function

Companies like Elsoms 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