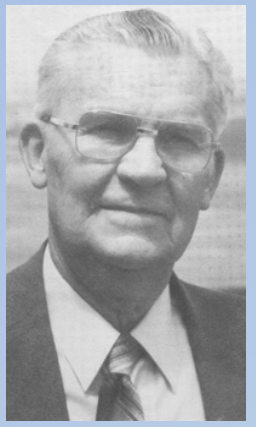
Crop Improvement Through Selection

Better Wheat = Better Bread!

Wheat Selection

Aegiops speltodes, ancestor of wheat, barley and rye



Dr. Vogel, Washington State University wheat researcher, developed Nu Gaines wheat, which increased crop yields and resistance to rust

How did the wheat you eat develop?

It is believed that modern day wheat is a direct descendant of Aegilops speltoides. A native plant in the"Fertile Crescent" of Asia and North Africa. When humans stopped being hunters and gatherers, they started growing wild crops. In time they kept seeds from the plants that produced the best flavor (selection for a trait). Thousand of years of this type of selection produced many varieties, (types of wheat).

Example of crossing wheat varieties for targeted trait

Performing Cross Breeding of wheat.

Scientist in the early 20th century began to selectively breed wheat to produce varieties that were needed for consumption by humans and animals. Farmers also demanded new varieties to increase yields plus be more resistant to pathogens. The bread industry required that wheat have "good taste" and was easily milled

Traditional Selection

After crossing plants for a targeted trait, test plots of the different wheat crosses are made and and the desired seed varieties are planted.

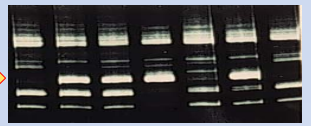
Traditional breeding methods include visual selection followed by quality and resistance tests to select the best combinations of targeted traits.
In the example to the left, a large team is required to hand inoculate a field with virus to select for resistant lines.

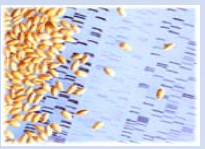
After hand inoculation, the wheat crosses which are not resistant to the targeted trait die. Seeds from the surviving wheat plants are collected and returned to the lab for quality and yield results.

Marker Assisted Selection

Traditional selection for targeted traits can take years to study because at the most one can only produce two generations of a wheat variety each year. Plus it can take the effort of several individuals, planting, inoculating, harvesting, and selecting for the target trait. Now, selections can be made more efficiently with a process called **Marker Assisted Selection (MAS)** where molecular markers close to genes of interest are used to assist breeders in selecting the best gene combinations.

The arrow shows a diagnostic band that is used to differentiate between lines with and without the targeted trait.





Using MAS a single individual can go through hundreds of seedlings to identify plants with the targeted trait.

The combined use of traditional breeding with genomics, genetics, and bioinformatics opens a window of opportunity to accelerate the development of new wheat cultivars with enhanced yield, quality and disease resistance.

National Science Foundation

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