

## Wheat and Barley Breeding in Australia

By AGT

Wheat is the most important winter cereal crop produced in Australia, accounting for an estimated 59% of the planted area. Barley accounts for approximately 17% and Canola 12%. The wheat market is typified by 95% farmer saved seed.

Based on this, where do new elite wheat or barley varieties fit in the Australian market? The issue from the breeder's perspective is how to capture a return on the investment in developing the variety. On average it costs \$3 million and takes up to 10 years to breed a new variety.

Firstly we should look at why would a grower plant a new wheat or barley variety?

If we look at what growers are striving to achieve, yield is seen by most to be the driving force. If changing from your standard variety to a new variety that could deliver a consistent 2-3% yield increase it would be well worth considering. Most new varieties deliver not just yield improvement, but generally also have

improved status for other traits including Root Lesion Nematodes, rust resistance or quality.

The issue from a grower's perspective is the cost associated with new varieties, but realistically if breeders don't cover their costs how can they continue to invest in new improved varieties. It is a balancing act, where the risk should be shared by both the breeders and the growers.

### Plant Breeders Rights and End Point Royalties

In 1994 there were amendments to Plant Breeders Rights legislation which created greater incentive for private investment. The amendments allow breeders to capture a return on investment at any single point in the use of the variety. 1998 saw the introduction of End Point Royalties (EPR), following support from grower organisations. This has led to significant changes in the Australian Wheat breeding industry.



The most significant change was in the funding; the industry moved from a 98 percent public funded sector investing an estimated \$18 million in 2000, to a 100 percent privately funded industry investing in excess of \$45 million a year. The introduction of the End Point Royalties enabled private enterprise to capture a return on the investment in new varieties. With this return much more is being invested into breeding programs to deliver improved yield, quality and disease resistance.

As indicated by Mr Kerrie Gleeson of Australian Grain Technologies (AGT); "With End Point Royalties growers pay for all production apart from any seed retained for their own use, this ensures that breeders share the risk with farmers. In poor years where production is down, so too are the returns from End Point Royalties."

The use of End Point Royalties in Australia does not stop grower to grower sales. AGT have a seed sharing system, while InterGrain has seed club members. The variety central website also identifies varieties where grower to grower sales are permitted.

Variety Central is a joint initiative, developed by the EPR steering committee and sponsored by a number of seed companies.



The web site details End Point Royalty prices for the 200 plus varieties included providing information on the price per tonne by variety. The End Point Royalty rates range from \$0.95 to \$4.25 per tonne depending on the variety. ([www.varietycentral.com.au](http://www.varietycentral.com.au)).

### The Variety Tunnel

The breeding process is a numbers game. A breeder will select two parent lines which contain the genes associated with specific traits. The parent lines may contain a number of genes for yield or quality or for tolerance or resistance to various pests or diseases.

A cross targeting 30 different genes would give the following probability of delivering the target variety that combined all 30 genes:

Frequency of 'target variety' =  $(1/2)^{30} = 1$  in 1,073,741,824

Therefore the greater the number of progeny created and tested the greater the probability of success. The more potential varieties created and tested the greater the cost.

The fundamental objective is to maximise the rate of genetic gain for every dollar invested. There are two primary considerations; population size and cycling time.

**Population Size:** The greater the number of populations the greater the chance of success. AGT Seeds for example run over 250,000 yield plots in Australia which is more plots managed than many important wheat breeding countries put together.

**Cycling Time:** This is the time from a cross to elite progeny as a parent. This is achieved through more generations in a year and by using technology such as DNA markers to help identify elite parents earlier. Breeders also utilise robotics and GSP technology to enhance high throughput in the field. The aim is to be able to create and assess as many potential varieties possible as efficiently as possible. This is where technology plays a key part.



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