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Planting seeds for a sound future

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Royalties have been collected on seed sales of all new crop varieties released in Western Australia by the Department of Agriculture since the release of Merrit lupins and Yilgarn oats in 1991. Many questions have been raised by farmers about these royalties: Why pay royalties when we have already paid for the development of the varieties through our Grains Research and Development Corporation levy? Why should we pay a levy if it is just going back into Government revenue? Is there any real benefit to us?

Peter Portmann explains the changing system for funding plant breeding and the need for continued support.

Creating a superior plant variety generally takes up to 12 years and between $500,000 and a million dollars in salaries and other costs. This sounds expensive, but when the value of the Western Australian wheat crop, for example, is measured in billions of dollars, such investment can pay for itself fairly quickly.

The Department of Agriculture in Western Australia has breeding programs in wheat, lupins, barley, oats and field peas. Funding by the State Government has been cut steadily over the past five to ten years in line with general reductions of funding for public service activity.

The proportion of funding contributed on a dollar for dollar basis by the industry and Commonwealth Government through the Grains Research and Development Corporation (GRDC) to crop breeding has increased over time and now accounts for about half of the finance needed to cover the direct operating costs of the breeding programs.

If you add overheads such as research station costs, laboratory and computing facilities, the GRDC contribution represents about 25 per cent of the true cost of the breeding programs.

Staff reductions and the need to reduce staff workloads for occupational health and safety reasons have resulted in a 35 per cent reduction in plant breeding activity since 1988.

Help from royalties

Royalties from seed sales by Registered Seed Growers are collected each year on all new varieties released by the Department. Plant Breeders’ Rights (PBR) have been sought with new releases, and under agreement with local farmer organisations royalties are now collected on the first three years of seed sales. Before PBR royalties were collected for the first year only.

Revenue over and above the cost of production of the seed provided to Registered Seed Growers to multiply for sale, is deposited in a trust fund, the Plant Research and Development Trust Fund. This fund was established specifically to manage monies generated through seed sales. From the net royalties a share is returned to the GRDC and other organisations which funded the development of the variety, in proportion to their assessed contribution.

The trust fund is managed by a group of four trustees, three of whom are farmers – Jim Grey from Esperance, Ian Hall at Quairading and Shirley Thorn from Bruce Rock. The trustees take advice from the Wheat and Field Crops Advisory Committees on the allocation of the funds to crop research conducted by the Department of Agriculture and collaborating organisations. In other words, all profits from royalties on seed sales are ploughed back into research for the benefit of farmers.

Trust fund uses

To date, most funds have been allocated to various development activities. These include the seed storage and cleaning facilities at Wongan Hills Research Station for pure seed lines of varieties under development. These facilities have been upgraded to handle the expanded number of lines under test as new crops and past expansions in the breeding programs make their impact.

Seed storage silos have been installed on a number of research stations to provide for the requirements of the greatly increased number of varieties being multiplied for release over the last few years.
The Reeves problem

Release of Reeves wheat in 1989 identified a totally new problem for wheat varieties known as late maturity alpha-amylase that caused the early and unfortunate demise of the variety.

In Reeves and other lines carrying this characteristic, an enzyme called alpha-amylase develops late in the grain development stage and remains at high levels in the mature grain. Normally the enzyme develops during germination when it is active in the process of breaking down starch to provide energy for the growing plant.

Because starch is such an important factor in many products including udon noodles, a high level of starch-degrading enzyme is a highly undesirable character to have in the grain. This is why sprouted grain, or grain that has started to germinate, is downgraded on receipt.

Before Reeves and other lines were developed around Australia at the time, this character was not known to exist. It was thought to have been introduced from the international wheat centre CIMMYT (International Centre for Research in Wheat and Corn) in Mexico.

Because of its excellent agronomic characteristics, Reeves had been used extensively as a parent in the breeding program. That meant that many lines in the wheat breeding program carried the same problem. It was important that the problem lines be eliminated as quickly as possible.

The trust fund provided a perfect opportunity to fund immediate screening and allowed the Department of Agriculture to employ staff to carry out the tedious process. It also allowed breathing space to incorporate this type of screening into the routine timetable for the wheat breeding program, and to seek a more permanent funding base for the on-going work.

Other challenges

Continual striving by breeders to increase the yield potential of new varieties and similar efforts by farmers to maximise the yields of those varieties, has put increasing pressure on quality factors such as grain size. In general, both of these pressures have a tendency to reduce grain size. This has become a particular problem in the wheat program where early generation selection for grain size had not been practised.

(In contrast, such screening has been routine in barley and oat breeding programs for more than 20 years because of market requirements, and the same problem has been avoided.)

Therefore we need to heavily screen material in the wheat breeding program for grain size to counteract the trend towards small grains. Funds were made available from the trust fund to employ casual staff to carry out this work until alternative funding could be organised through GRDC.

Plant breeding programs depend heavily on computing facilities to keep track of thousands of plants each year and to analyse results. Over the past 20 years extensive computing software has been developed to serve the programs. This system has become obsolete and it is now necessary for a complete upgrade of both computing hardware and software.

It is difficult to obtain funding for such infra-structure from GRDC because it is not associated with specific research programs. The trust fund has allowed breeders to get started on this major project before it is too late.

The increasing rate of release of new varieties has put heavy pressure on the Department’s resources for producing seed. Increasingly it has been necessary to contract pure seed production on farmers’ properties. This is a new cost outside the Department’s traditional finance base. The trust fund has been useful in providing the flexibility to contract this work. In this case the outlay of funds is eventually recouped when the new variety is released.

Royalties from the canola variety, Narendra, bred in Western Australia in the 1980s, have been used to fund the salary of a Canola Development Officer, appointed to Katanning in 1994.
From these examples it can be seen that the Plant Research and Development Trust Fund has provided the Department with increased flexibility to respond to urgent research needs while allowing important research that otherwise might have not been possible, or at best have been delayed at considerable cost to the industry.

As research funding becomes tighter, sources such as the Plant Research and Development Trust Fund are becoming strategically important. It is another way in which farmers are investing in research from which they eventually reap rewards.

Most farmers realise that the benefits from plant breeding come at relatively little cost. They need not buy any more than a tonne or two of seed to get into a new variety. At the going rate for seed that is an insignificant cost within a cropping program. When you work out the benefits of a variety with even a 2-3 per cent increase in yield, the variety pays for itself very quickly and proves an excellent investment.

**Plant Breeders' Rights**

In the past many farmers have relied on others to buy into a new variety and have then used them by “swapping a truck load at the bin”. With the advent of Plant Breeders’ Rights that option is now illegal. The risks of breaking the law and getting caught are significant and the penalties are high (up to $50,000 for an individual and $250,000 for a corporation).

For an outlay of $400–$600 for a tonne of seed and some minor inconvenience in multiplying seed, farmers can be into a new variety quickly without any risk of prosecution. It also gives them a good opportunity to assess a new variety in their own system, before committing a significant part of the farm enterprise to a totally unknown variety, and that’s good business.

PBR will force many farmers to modify their pattern of adoption of new varieties. If they want to get into a new variety quickly they will need to buy in the first year of release and not wait to see how the neighbours fare. That will benefit them in the long run and in time they will probably come to recognise that.

Buying seed of a new variety from a Registered Seed Grower will give them the opportunity to buy clean seed of known origin with a seed analysis that gives them a clear indication of any problems that they may be buying with the seed. Herbicide-resistant weeds are an increasing problem and it is worth paying the price for good clean seed if it means preventing a new problem.

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The process of developing seed of new crop varieties takes many years with trials in many different locations.

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**Normal stages of crop breeding**

- **Initial crossing**
- **Unfixed segregating crossbreds**
- **Plant breeding**
- **True breeding lines**
- **Commercial Evaluation**
- **Release to Registered Seed Growers**
- **Release to Farmers**
- **Variety testing**

![Diagram showing the stages of crop breeding](image-url)