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Grain quality testing

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Cereal breeders, armed with every improving breeding and testing technology produce thousands of new crossbred lines every year. These must be carefully selected for basic features such as yield, straw strength, plant height and disease resistance.

Grain quality must also be taken into account and for this reason plant breeders work in close collaboration with cereal chemists.

At the Western Australian Department of Agriculture, grain quality testing is carried out by the Grain Products Laboratory. Quality selection starts at an early stage in the breeding programme and only those lines showing marketing potential are promoted for further testing.

About 4 500 lines of wheat and 3 000 of barley undergo preliminary quality tests every year and generally only about one-quarter of these get cleared for further testing at this stage.

This rigorous 'screening' ensures that effort is not wasted in yield testing poor quality lines.

**Improved technology**

Cereal breeders have been very successful at adapting technological advances to increase the effectiveness of their efforts. An example of this is specially designed machinery to increase the number of test plots and rows they can sow and harvest every season.

In the same way, the quality testing support staff must seek ways to keep pace with the ever-increasing number of lines which survive the preliminary screenings in the field.

For example, our Laboratory is assessing the potential of near-infra-red reflectance analysis equipment. This technique offers a way to speed up the early phase quality tests to several times the Laboratory's
Quality tests
The quality we seek in any cereal grain is determined by existing and potential markets... in other words by the end uses expected of it.

Locally, wheat is used mainly for conventional leavened (yeast treated) bread, but large quantities of Western Australian wheat are sold overseas for other end uses including unleavened bread, noodles of various types and other food items such as cakes and biscuits. These end uses require a range of wheat qualities.

Internationally, wheat is marketed according to quality class—those classes important to W.A. are Australian Hard, Australian Standard White and Australian Soft. Quality objectives have been set for each. Varieties being developed for Australian Hard should have hard (but not excessively hard) grain and strong and extensible dough. At the other extreme, varieties for Australian Soft are required to have soft grain and weak but extensible dough. Varieties with intermediate dough strength, good extensibility and moderate grain hardness are required for Australian Standard White. Good milling quality—which takes into account flour yield, ease of milling and ease of conditioning—is a basic requirement for all new varieties.

The protein level of wheat produced for sale is most important. In this respect, buyers demand high protein hard wheat and low protein soft wheat. Thus the production of hard varieties is encouraged in areas where high protein levels can be expected while soft wheats are favoured in lower protein areas.

Although the wheat breeder has only limited control over the protein level present capacity. But if the method is to be accurate enough for such screenings, then the instrument must be very carefully calibrated against analytical results from conventional tests.

If the Laboratory can achieve useful calibrations, the new process could become the basis for quality ranking whole batches of new lines to reduce the numbers requiring more detailed tests.
Rapeseed

Last year, more than 8,600 preliminary tests were carried out on new lines of rapeseed. The rapeseed breeding programme is expanding now that blackleg resistance has been established, but to be commercially successful any new variety must have low levels of erucic acid in the oil, and preferably low levels of glucosinolates in the meal. Low erucic rapeseed oil is required for human consumption, and low glucosinolate levels are preferred in meal used for stock feed.

The Grain Products Laboratory uses the technique of thin-layer chromatography for rapid screening for erucic acid levels and another quick and inexpensive test for glucosinolates. The Laboratory's nuclear magnetic resonance analyser is used to screen the new lines for their oil content.

Following the release of several low erucic varieties and one having low levels of both erucic acid and glucosinolates, attention is now being given to further improving the quality of the oil by varying its fatty acid composition. The Laboratory is closely involved in this work through analysis by gas-liquid chromatography. Rapeseed lines with higher levels of linoleic acid and lower levels of linolenic acid are being sought in this work.

The development of resistance to pod shattering is a major objective in the rapeseed breeding programme and attempts are now being made to develop suitable laboratory screening tests for this characteristic.

Oats

The first stage in testing of oats involves assessments of hectolitre weight, grain plumpness and colour. More than 1,600 lines were screened last year. As promising lines progress further, they are checked for grain percentage and protein level to determine their value either for milling or for stock feed.

The Wheat Products Laboratory uses the technique of thin-layer chromatography for rapid screening for erucic acid levels and another quick and inexpensive test for glucosinolates. The Laboratory's nuclear magnetic resonance analyser is used to screen new lines for their oil content.

Barley tests

The preliminary tests for new lines of barley apply to both feed and malting types. Last year over 3,000 lines were screened for hectolitre weight, grain plumpness and colour.

As the lines progress through the various stages of yield testing, more detailed quality tests are conducted, including micromilling and malt analysis to measure such characteristics as malt extract level and diastatic power—the capacity to convert starch to sugars.

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