Crop variety testing and recommendations

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From 1984 onwards, the Department of Agriculture’s crop variety recommendations for Western Australia will be set out in a new format directly related to the 18 variety testing areas into which the South-West has been divided. These divisions should enable growers to more readily identify the recommendations which apply to their area. In addition, yield data on the varieties are provided for each area.

The recommendations are the culmination of a lengthy process of breeding, selection and testing of crop varieties. This article gives the background to the tests and how the results are used as the basis for the recommendations.

Wide range

Farmers in Western Australia already grow more than 100 varieties of different grain crops, over half of which are wheat. Fewer than one-third of these varieties are officially recommended.

At the rate new crop varieties from the various breeding programmes are reaching the commercial stage, growers will find it more and more difficult to remain familiar with what is available, let alone try each new variety on their farms.

In 1982, for example, a record 19 new crop varieties were registered in Australia, including eight produced in Western Australia. All had varying degrees of potential application for this State.

Growing the best variety appropriate to the situation can mean big money. If a wheat crop producing a tonne per hectare, worth $150 a tonne, can be improved 5 per cent in yield, the grower’s profit margin is up $7.50 a hectare. But in the same way, if he picks the wrong variety and yield falls by 5 per cent, then profit drops $7.50 a hectare. Either way, this represents about 25 per cent of the profit many growers might normally expect.

It is extremely important, then, that farmers quickly identify and build up varieties which will yield well for them. Making objective
assessments in relation to yield and quality presents major problems because of seasonal variability, soils and other environmental effects.

Variety testing programmes are designed to take account of this variability. The systematic accumulation and analysis of data on yield, quality and field characteristics provides scope to ‘fine tune’ recommendations to make them more relevant to individual farms and localised situations.

Testing programme

In 1966 Western Australia started a comprehensive variety testing programme, supported by research funds, to more accurately define the performance of new varieties.

The basis of the programme is a network of test sites whose locations cover the major climatic variations in the South-West Province. The crop-growing area is divided into 18 distinct testing areas representing combinations of annual rainfall and latitude, as shown on the map on page 60.

The State is divided in an east-west direction into four regions defined by the 750 mm, 450 mm and 325 mm rainfall isohyets. Other climatic elements having a strong latitudinal component—such as radiation, temperature, ‘break’ and length of growing season—are taken into account by subdividing the area into five zones from north to south.

For convenience, each test area is identified by a combination of a letter and a number, signifying respectively the rainfall region and the zone. The rainfall regions are denoted as VH (very high rainfall—more than 750 mm); H (high—450 to 750 mm); M (medium—325 to 450 mm); and L (low—less than 325 mm). The zones are numbered 1 to 5 from north to south representing northern, north central, central, south central and southern sectors. For example the high rainfall, north central area, known as the ‘West Midlands’, is area H2 on the map.

At least two testing sites are located in each test area. At each site a number of variety trials with different crops are sown near one another. They are usually sown on the same day so that comparisons can be made between the crops as well as between the varieties within the trials.

Up to 25 varieties are tested in a single field trial. Seed is drilled into plots varying in size from 12 rows x 60 m long with three replicates of each variety to 8 rows x 40 m and four replicates. The smaller plots are coming into more general use with the advent of cone seeders and nursery harvesters specially designed for plot work.

Trials are sown by district farm practice as far as possible. About three-quarters of the programme is sown on farms on land prepared
The difference between average trial yields and State wheat yields has lessened in the past few years.

Comparison of trial yields and Western Australian grain yields for wheat (1966 to 1983).

For the farmers' bulk crops. Normal fertiliser and seed rates are used. The use of herbicides is increasing in line with farmer use and many trials are now sown with minimum tillage. Date of trial sowing relates to the season and local practice.

The variety testing programme in 1983 comprised 546 field trials at more than 100 sites. More than 18,000 large scale plots were sown, the largest programme of trials ever sown in Western Australia. It reflects the increase in breeding activity compared with five years ago when the testing programme was only half the present size.

The field programme is conducted by Department of Agriculture staff at 16 district offices and 12 research stations, while overall organisation and assessment is the responsibility of a small group located at the Department's head office in South Perth. Data processing and field organisation—the production of seed supply lists, grain sample labels and field schedules—are computerised. Electronic data logging devices will soon be used for all field checking and data recording, eliminating most of the tedious hand recording and reporting.

Yield data

All trials are machine-harvested and the weight of grain from each plot is recorded. The results are subsequently processed for computer storage and analysis. The computer record or 'data bank' contains the results of more than 6000 crop variety trials harvested in Western Australia since 1940. Yield information is available for more than 1400 varieties extensively tested during that period.

More than 5000 trials have been carried out since 1966, providing an opportunity to compare variety trial yields with farm yields. The graph shows the close relationship over an 18-year period between the average yield of Gamenya wheat in trials and the State average wheat yield. Gamenya dominated wheat sowings during this period, rising from 38.5 per cent of sowings in 1966 to 63.1 per cent in 1974 and falling to 43.7 per cent in 1983.

The highly significant correlation (r = 0.83*** between the State average wheat yield and trial yields for Gamenya suggests that variety trials have reflected fairly accurately the variation experienced on farms. However, Gamenya trial yields were appreciably higher than State wheat yields, probably because of over-estimation in converting trial plot yields, exclusion of failed trials, and not selecting potentially adverse sites for trials. In addition, particularly in the earlier years, much of the State's wheat-growing area was sown to varieties which would have been lower yielding than Gamenya. The graph suggests that the difference between trial and State yields has been less marked in recent years.

Analysing yield trends

The location and characteristics of each site are taken into account in analysing the results of variety trials. The major trends in relation to area are considered by comparing the average yield of varieties when sown in the same group of trials. For convenience, these average yields are expressed as a percentage of a selected control variety.

The table (on pages 60-61) lists the long-term yield information for 42 wheat varieties compared with the control variety, Gamenya, with respect to 15 testing areas in the high, medium and low rainfall regions. This summary was produced by computing the results of more than 2000 wheat variety trials carried out since Gamenya was first introduced in 1961. The number of comparisons is included in the table to indicate how many paired comparisons of yield were totalled to arrive at the mean percentage.

The table is a guide for comparing varieties, but direct comparisons between particular varieties are often needed to determine which one should be recommended. Also the table represents average yields for an area and is not adjusted for time of sowing, soil type or other factors influencing yield.

The yield data are regrouped in various ways to reveal overall trends associated with rainfall regions, north-south zones and times of sowing. Other trends considered are soil groups, aspect, development history and rotations. Combinations of major factors, such as soil groups within rainfall regions, are also studied.

Here are some examples of the effects of these test factors and the interactions produced.

Rainfall. The average yield of Aroona wheat falls from 111 per cent of Gamenya overall in high rainfall areas to 102 per cent in low rainfall areas. The yield of Gutha rises overall from 91
per cent in high rainfall areas to 105 per cent in low rainfall areas.

Zones. Illyarrie lupins outyield Yandee in northern zones but not in southern zones.

Time of sowing. In high rainfall areas, Egret wheat can yield 33 per cent more grain than Gamenya when sown in early May. If sown in July it is likely to yield 7 per cent less. In southern high rainfall areas (area H5 on the map) the difference widens to 42 per cent more and 9 per cent less.

Soil type. Bodallin and Gutha wheats are best adapted to heavier soils in the eastern wheatbelt; Canna shows greatest superiority on light soils in the medium and low rainfall areas.

Aspect. There are indications that aspect may be important for some varieties. For example, the superiority of Forrest barley over Clipper in some areas appears to be associated with a northerly aspect.

History. Development of leguminous pastures leading to higher levels of fertility may mean a change in the variety required. Many modern cereal varieties are specifically adapted to high yielding conditions, for example, Egret wheat compared with Bencubbin.

Rotation. Some varieties may be better adapted to 'tight' rotations involving frequent or even continuous cropping. This may be associated with disease resistance or adaptation to reduced fertility.

Other criteria
Grain quality and field characteristics are important aspects of variety evaluation.

Crop varieties must meet certain minimum commercial quality standards which vary according to the crop. For bread wheat this includes test weight, milling yield and baking quality. For manufacturing barley it means emphasis on test weight, grain size and malting quality. Extensive laboratory analysis is required to assess how varieties compare according to area and conditions, including different soils.

Field characteristics such as maturity, height, disease resistance, straw strength, and grain and head loss are important. A variety may have restricted recommendation if it has a major field problem.

Making recommendations
Variety recommendations are based on an annual appraisal of the latest yield data and supporting information on quality and other characteristics. In the case of new varieties, a decision must be made on whether the data are sufficiently conclusive to warrant release or recommendation and the areas where the variety is best suited. It is important that the test data are accurate and adequate, and early decisions are required if a new variety is to be of benefit to growers.

Where it seems clear that varieties have particular application, such as to specific areas, soil or sowing times, the recommendations are framed accordingly. Theoretically, for each situation there should be a single superior variety, and this is a guiding principle in recommending varieties. Because of the limitations of the data, however, and the desire among growers for choice of variety, alternative 'second choice' varieties are usually suggested.

Recommendations are based primarily on the average performance of varieties in the situations concerned. No attempt has yet been made to cater for varying levels of risk, although the stability of varieties in relation to changing yield potential is routinely assessed during data analysis.

Draft recommendations covering commercial varieties and proposed new releases for each crop are prepared by the Department of Agriculture.
Agriculture. These are critically reviewed by advisory bodies who assess each set of proposals in terms of its commercial impact—from farm to overseas buyers.

The State Wheat Advisory Committee comprises four farmers; two Australian Wheat Board officers; one representative from the Grain Pool of W.A., CBH, the stockfeed processing industry, the malting and brewing industry, the University of Western Australia, and the Department of Agriculture. Once again, the chairman and secretary are also from the Department.

The final recommendations, which are published as a series of Department of Agriculture Farmnotes at harvest each year, are a blend of technology and market intelligence. The Farmnotes give growers sufficient detail to help them decide between new and old crop varieties. In the final analysis this is where the matter rests—with the grower.
There are a lot of misconceptions and myths about dermatophilosis, a disease which can kill young lambs, affect wool quality, make shearing difficult and make sheep susceptible to fly strike.

One misconception is perpetuated by the incorrect use of the common name mycotic dermatitis, which implies that a fungus causes the disease. This is not so.

The disease is caused by the bacteria Dermatophilus congolensis, which attacks the sheep's skin and eventually forms a lesion or scab in the wool, and so is better called dermatophilosis, 'dermo' or 'lumpy wool'.

Veterinary Epidemiologist at the Albany Regional Office, J. R. Edwards, discusses some of the myths associated with 'dermo'.

- 'Dermo' lesions in wool showing the typical 'cauliflower tips' appearance seen in severe cases.