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BARLEY

breeding update

By P. A. Portmann, Senior Plant Breeder (Barley)

Barley production in Western Australia has increased over the past few years, peaking at 1.42 million tonnes in 1984. The European Economic Community, however, has flooded world markets for barley and over half of our barley was sold for feed to Saudi Arabia last year. Current prices therefore have declined as has the total area sown to barley in this State.

Despite this, the potential to increase barley yields is most promising. The Department of Agriculture has cross-bred lines in advanced stages of field testing which could increase yield by 10 per cent across the agricultural areas.

In the longer term, particularly in high rainfall zones, barley yields could probably double with earlier plantings and appropriate agronomy. The recent investment in agronomic research in barley is likely to pay big dividends.



Location of trials

In 1985, the barley breeding programme involved 12 sites throughout the agricultural areas and some 60 000 plots. The programme operates from three main centres: Mt Barker (high rainfall programme), Wongan Hills (medium rainfall) and Merredin (low rainfall).

There are also nine supplementary testing sites: High rainfall—Esperance, Katanning and Badgingarra; medium rainfall—Katanning, Newdegate, Badgingarra and Chapman; and low rainfall—East Chapman, Perenjori, Lake Brown and Salmon Gums. The inclusion of East Chapman in 1985 provided a site for the short season, lower rainfall northern environment.

The 1985 season was satisfactory, providing a good set of testing sites for screening



□ Some conventional lines of barley (foreground) do not have a strong straw and may collapse. Dwarf barley lines used in cross-breeding (rear) could produce earlier maturing, taller dwarf types with a stronger straw.

breeding lines. Plantings at Lake Brown were damaged by hail at harvest and lost and the Esperance site was severely weather damaged just before harvest.

The late start to the season meant most sites were sown late and this probably biased results against long-season breeding lines in the high rainfall programme.

Current varieties

The total area sown to both Clipper and Forrest barley in the State is declining rapidly, with Clipper predicted to account for only four per cent of the planted area in 1986 and Forrest eight per cent. Plantings of Stirling have increased to about 70 per cent of the area sown to barley, while the newer variety O'Connor occupies 10 per cent of the planted area.



□ Dwarf barley lines and conventional breeding lines. This is part of a selection for later maturing barley lines for higher rainfall areas.

There were widespread reports of heavy powdery mildew infection on most varieties, particularly Stirling. O'Connor barley was noted to be highly susceptible to barley yellow dwarf virus during an unusually severe epidemic of this disease in the southern high rainfall barley growing areas. This should not be a serious problem because the variety is not recommended for those areas.

The malting evaluation of farmer grown samples confirmed that O'Connor barley will not be classified as a malting barley. Deficiencies such as high screenings, a high dormancy rate (slow germination within a few months after harvest) and a poor modification rate (rate at which starch is converted to sugar) together make it unsatisfactory for malting.

Advanced cross-bred lines

Three advanced cross-bred lines have grown exceptionally well in the southern high rainfall and very high rainfall zones. These advanced lines have excellent straw strength, good disease resistance, excellent head retention and their yields have been extremely good. They are being evaluated for release in 1988 in southern high rainfall barley areas. Although the physical quality of these lines is excellent, they have poor malting performance and will only be considered for feed. Their evaluation and release will be considered against the good performance of Schooner in relevant areas.

Several cross-bred lines in the variety trials show promise for both yield and malting quality. One line, 75S/323, outyields Stirling and O'Connor in the high, medium and low rainfall zones. Preliminary results indicate it has promising potential for malting. After the 1986 trial results it will be considered for release.

Isogenic pairs

A series of isogenic lines (two breeding lines which differ theoretically by one gene) for the 2-row and 6-row genes have been developed and we now have enough seed of pure-line, true breeding stocks for extensive trials in 1986. These trials will study the effect of the 2-row and 6-row genes on barley yield and quality in our environment.

Herbicide tolerance

Herbicide trials over the past three seasons have indicated the need for much more intensive work to establish the amount of possible damage to cereal varieties from a range of herbicides. The Department has re-structured its research into herbicide



□ Plant breeding yield trials at Mt. Barker—oats, wheat, barley and rapeseed.

tolerance of cereal varieties. The Weed Agronomy Branch in co-operation with district offices have started extensive trials on recommended varieties, allowing testing of herbicides appropriate to the growing area.

Herbicide tolerance research on advanced cross-breeds is still carried out at Wongan Hills Research Station. About 10 herbicides are applied to advanced cross-bred lines at twice the recommended rate so that major interactions between the herbicides and cultivars can be detected. Where there is a problem further more detailed evaluation can be carried out. Apart from the well-known effects of some specific herbicides on barley, the data indicate there is little interaction between barley cultivars and most herbicides.

Screening for disease

Extensive nurseries for disease screening were again established at Mt Barker, Badgingarra, Wongan Hills and Chapman Research Stations.

The net blotch sites at Badgingarra and Wongan Hills gave very low levels of infection, resulting in virtually no selection for net blotch resistance. This resulted from the very late seeding of those sites.

The scald nurseries at Mt Barker and Badgingarra gave moderate levels of infection and some useful screening for scald resistance was possible.

The Mt Barker site was heavily infected by unusually high levels of barley yellow dwarf virus and this created some complications in these nurseries, but more particularly for the fungicide trials used to assess the effect of scald on the yield of advanced cross-bred lines.

Barley yellow dwarf virus will be monitored in subsequent years to see if there is any permanent change in disease levels requiring a change in breeding emphasis. The results of the 1985 season suggest that the barley material in the breeding programme has fairly high levels of tolerance of barley yellow dwarf virus, particularly when compared with oats and wheat.

Powdery mildew was again severe in high rainfall zones, particularly along the south coast and in the West Midlands. Some lines in the breeding programme and in the variety trials have some resistance to powdery mildew, but such resistance will probably be short-lived due to the high variability of the disease. Several powdery mildew strains exist and these strains can very quickly change in response to new sources of resistance, in much the same way

as wheat rusts, but worse. Forrest barley has lost its resistance to powdery mildew and is now among the most susceptible of the recommended varieties.

This high variability of mildew makes breeding for specific resistance unproductive. The best control methods against powdery mildew at present are seed dressings which are proving most effective, in conjunction with any genetic resistance of new varieties.

The overall significance of powdery mildew is still uncertain, but evidence suggests that fairly high levels of disease are needed to produce significant reductions in yield.

Dwarf lines

In 1985, we tested a large number of dwarf lines at the high rainfall sites. This was the first opportunity we have had to study such numbers of this type of breeding material and to assess its yield potential.

The dwarf lines are considered to be longer-season material, and despite the very late start to the season yields have been exceptionally good. Preliminary results indicate that some of these lines outyield our most promising cross-bred lines and commercial varieties by 15 to 20 per cent. The best dwarf lines will be tested further in 1986.

Some of the taller, dwarf-type lines with a plant height equivalent to Stirling were tested in the medium and low rainfall programmes. Yield was disappointing in all trials. In the medium and low rainfall trials this could result from its maturity and the season starting much later than usual. Some of these lines have been used in cross-breeding to develop earlier maturing, taller, dwarf types with a stronger straw. However, yield results from 1985 indicate there is some way to go before such material is suitably adapted to the medium and low rainfall zones.

Winter barley

We tested several winter barley lines introduced by R. Boyd of the University of Western Australia and a number of these lines have performed exceptionally well, with good levels of disease resistance and straw strength. They have the potential, based on yield, to be released in their own right as cultivars for growing here. The very late break to the 1985 season has probably biased yield results against them, and we anticipate that they will show even better potential when tested under earlier sowings than was possible in 1985. Crosses were made with these lines in 1985 and further crossings in 1986 will help develop winter-type barley lines better adapted to our environment.

Head loss trials

Head loss trials were conducted at Mt Barker and Esperance Downs Research Stations and for the first time at Wongan Hills Research Station. The trials indicate breeding lines susceptible to head loss with delayed harvest.

The three promising cross-bred lines mentioned previously and the dwarf lines show very good head retention even after extensive delays before harvest. The trials continue to confirm early observations that O'Connor barley is highly susceptible to head loss if harvesting is delayed.

The advanced dwarf-type lines which will enter stage three trials in 1986 have exceptional head retention, even at Esperance where standing barley crops suffered big losses. These lines have about half the head loss of Stirling, which is one of the best varieties currently available for resistance to head loss.

□ Barley scald, one of the major barley diseases in this State.

