Growing barley for grain in Western Australia: barley quality

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GROWING BARLEY FOR GRAIN IN WESTERN AUSTRALIA

BARLEY is an adaptable crop which can be grown successfully throughout the cereal areas of Western Australia. It is more suited to the wetter areas than wheat and tolerates the drier, shorter season of the eastern cereal districts better than oats.

The general principles of barley cultivation are, by and large, those which apply to most crops. Specific requirements for cultural methods and quality are outlined in this article, together with comments on the economic prospects of the crop.

In recent years overseas trade in barley for stock feed and for malting has increased. Considerable advance has been achieved locally in producing high grade barley in both categories for overseas markets and in developing an export trade.

Interest in barley has intensified following the introduction of quotas for wheat. The fact that marketing outlets for barley were established and prices were satisfactory have been major inducements producing a marked swing to barley as an alternative to wheat.

Areas and soils

The highest barley yields are obtained in higher rainfall areas, particularly southern districts where the season is long. Yields of over 80 bushels an acre have been recorded in trials in these areas. But good yields are also achieved in drier areas and barley can be grown successfully throughout the cereal area from north of Geraldton to the south coast.

Like other crops barley yields best on fertile soils, well drained but with good moisture holding capacity to provide adequate moisture for end-of-season requirements. Barley responds well to late spring rains.

Barley shows considerable adaptation to less fertile soils and less favourable situations. It has proved an important crop in the development of new light land in many areas, notably the northern sandplain areas. It has greater tolerance than wheat or oats to salt-affected soils such as the fluffy "morrel" soils of the eastern wheatbelt or the "Kopi" and "Kumarl" saline soils of the south eastern mallee.

Vigorous early growth and some resistance to root rot give it a better chance of persisting in waterlogged or weedy situations although such conditions normally take heavy toll on yield.

Cereal production in Western Australia

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>20-9</td>
<td>49-9</td>
<td>53-3</td>
<td>63-9</td>
<td>102-2</td>
<td>103-2</td>
<td>107-0</td>
<td>112-5</td>
</tr>
<tr>
<td>Oats</td>
<td>4-1</td>
<td>7-9</td>
<td>16-5</td>
<td>21-8</td>
<td>23-3</td>
<td>22-1</td>
<td>19-8</td>
<td>22-9</td>
</tr>
<tr>
<td>Barley</td>
<td>0-7</td>
<td>0-9</td>
<td>4-7</td>
<td>8-5</td>
<td>6-5</td>
<td>6-7</td>
<td>7-0</td>
<td>9-2</td>
</tr>
</tbody>
</table>

The success of this change will depend partly on how efficiently the crop can be grown in the face of economic trends in the industry over the next few years. Quality of the grain offered for sale could have an important influence also.
The most common application of barley is as a first or second crop on clover ley land in the medium and high rainfall areas with more than 13 inches of rain annually.

Varieties

Barley varieties are required which stand well, do not lose heads in strong wind and do not shed grain from the head when left standing after maturity. Threshing must be easy. Disease resistance and a high yield of high quality grain are naturally very desirable.

Commercial barley varieties belong to two distinct groups—two row barley (*Hordeum distichum*), and six row barley (*Hordeum vulgare*).

In Western Australia two row barley was once used exclusively for malting while six row barley was exported as a feed barley. Today this association with distinct end use is not so well defined. Both types may be used for either purpose, although two row is generally preferred for malting.

Varieties recommended in this State are Dampier (two row) and Beecher (six row).

**Dampier**

Dampier was produced by the W.A. Department of Agriculture from a cross between a selection from Olli and Research and was released to farmers in 1967.

It is an early-midseason maturing variety requiring a medium length growing season so does not yield particularly well in drier areas. It has medium height, strong straw which stands well. It is much superior to Prior in its ability to stand windy conditions without going down or losing heads.

The head has a characteristic tapered shape with medium length, large, plump, white grain. Dampier is notable for the lower percentage of small grain when compared with other varieties.

It produces high grade malting grain with good extract and satisfactory nitrogen content when grown under suitable conditions.

**Beecher**

Beecher was introduced from U.S.A. where it originated from a cross between Atlas and Vaughn.

It is early maturing and yields well in short season areas. It has medium height, strong straw and stands well.

Heads and grain are held strongly and Beecher is somewhat harder to thresh than Dampier.

The grain is white and smaller than Dampier. Associated with this is a higher percentage of small grain through a 2.5 m.m. sieve. The grain has more husk and higher grain fibre than some varieties but is suitable for feed grain and is used for malting to some extent.

Dampier yields less than Beecher over most of the cereal area. However, Dampier is the main variety sold as manufacturing
grade and returns are usually higher where grain of suitable quality is produced. It is therefore the first choice in areas with more than 13 in. rain for suitable situations.

Where feed grain is to be produced either Dampier or Beecher may be grown and the choice will depend on which yields best. Trial results indicate that Dampier outyields Beecher only with later (June) sowing in southerly districts with over 18 in. annual rain. In practically all areas early sown Beecher would be expected to give the best yields of feed grain.

Other varieties are grown to a limited extent. While they are generally lower yielding the position is also influenced by stipulations on variety in the barley trade. Unlike other cereal crops there is little tolerance of variety mixtures, particularly for manufacturing grade where processing is geared to the grain characteristics of a particular variety.

The table showing areas of varieties grown in W.A. in 1968-69 season illustrates the extent of the restriction to main varieties.

An active barley breeding programme has been carried out locally for many years with emphasis on yield and grain quality. Pedigree seed of leading varieties is produced by the Department of Agriculture for sale to farmers.

### Varieties of barley 1968/69 season

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Area (acres)</th>
<th>Per cent. of total area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Row—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dampier</td>
<td>115,821</td>
<td>20.1</td>
</tr>
<tr>
<td>Prior</td>
<td>73,675</td>
<td>12.8</td>
</tr>
<tr>
<td>Maltworthy</td>
<td>3,859</td>
<td>0.7</td>
</tr>
<tr>
<td>Noyep</td>
<td>2,671</td>
<td>0.5</td>
</tr>
<tr>
<td>Proctor</td>
<td>918</td>
<td>0.2</td>
</tr>
<tr>
<td>Resibee</td>
<td>129</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>4,261</td>
<td>0.7</td>
</tr>
<tr>
<td>Total two row</td>
<td>201,334</td>
<td>34.9</td>
</tr>
<tr>
<td>Six Row—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beecher</td>
<td>368,033</td>
<td>63.7</td>
</tr>
<tr>
<td>Atlas</td>
<td>5,785</td>
<td>1.0</td>
</tr>
<tr>
<td>Other</td>
<td>2,338</td>
<td>0.4</td>
</tr>
<tr>
<td>Total six row</td>
<td>376,156</td>
<td>65.1</td>
</tr>
<tr>
<td>Total barley</td>
<td>577,490</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### Cultural requirements

#### Land preparation

A weed free situation is essential for good barley production. Weed infestation reduces yield and also affects grain quality. Moisture stress at the end of the season in a weedy crop will increase the amount of small grain produced.

The principal objective in preparing land is to cultivate as early as possible consistent with good weed control. Stubble from previous crops or excessive pasture residues should be grazed off or burnt rather than ploughed in.

#### Fertilisers

Barley requires similar fertilisers to wheat. It responds in the same way as wheat to nitrogen and phosphorus fertilisers. However because returns for barley...
are usually lower than for wheat it does not pay to use as much of these fertilisers as would be applied with wheat.

Recommendations on superphosphate application are associated with previous applications. As a general guide superphosphate rates range from 30 lb. an acre on old well fertilised land to 220 lb. an acre on new light land which is being cropped for the first time.

Nitrogen fertiliser application is related to the area, the rotation and the type of barley produced. With barley for feed grain nitrogen fertiliser can be used freely up to the limit set by economic return. This will vary according to the situation and full details are provided by Mason (1968) in Bulletin 3575.

Nitrogen fertiliser is seldom an advantage on heavy land. Rates commonly used for first crops on new light land range from the equivalent of 30 lb. urea in drier districts to 85 lb. in wetter areas. On clover ley land rates for first crops are reduced to nil in the drier areas and 50 lb. in wetter districts. Where barley is sown following a previous cereal crop the rates are increased to compensate for the drop in soil fertility.

With barley for malting caution is necessary in deciding on nitrogen rate. Excessive rates may result in grain protein being too high for good malting grain. Half the rate recommended for feed barley production is considered a good guide for application on barley crops for malting.

The trace elements, copper and zinc are required for barley and should be applied where barley is grown on new light land. Recommendations as for wheat apply and are given in detail by Gartrell and Glencross (1968) in Bulletin 3614.

Seeding

Time of seeding is determined largely by seasonal conditions and the need for weed control. Early sowings normally give higher yields. However, in wetter districts very early seeding (early May) increases the risk of weather staining of the grain due to early maturity under moist, cool conditions. Towards the end of May is a good time to sow barley in wetter areas; in other districts or on new light land earlier sowing could be beneficial.

Barley seed sown at 40-45 lb. per acre on well prepared land gives maximum yield. Where weed problems are anticipated higher seed rates up to 60 or 70 lb. per acre will help to combat weeds to some extent and will improve yields under such conditions.

A seeding depth of 1⅛ to 2 inches is recommended.

Good quality, graded seed pickled with a mercury fungicide should be used.

Grazing for early feed

Crops intended for grain should not be grazed at all as each grazing reduces final grain yield.

Weed control

Control of broad leaved weeds in the growing crop is possible using the selective herbicides 2,4-D amine, 2,4-D ester, Buctril, Linuron and Dicamba. Wild oats can be controlled using Carbyne. Time of application of herbicides is important. Detailed recommendations are given by Pearce (1969) in Bulletin 3646 and Paterson (1969) in Bulletin 3649.

Diseases

Barley is susceptible to a range of diseases which affect yield and grain quality in varying degrees. The main diseases are loose smut, covered smut, rootrot, scald, net blotch, powdery mildew and barley yellow dwarf virus. Grain moulds are important in relation to grain quality. Many diseases are more serious in the wetter, cooler areas. Attention to selecting and pickling the seed, disposal of crop residues and rotation are important in minimising disease. Descriptions of diseases and recommendations on control are given by Shipton and Tweedie (1968) in Bulletin 3621.

Insect pests

Barley is relatively free from serious insect pests in the field. In some seasons webworm can cause serious damage in the establishment phase, though damage is usually less than with wheat.
Control of webworm can be effected through suitable cultural and rotation practices and directly using D.D.T. insecticide. Details are given by Button (1963 and 1966) in Bulletins 3174 and 3425. Early spraying is emphasised as an important feature of control.

Rotation

Barley is susceptible to some diseases attacking other cereals. In particular it is a favourable host for build up of root rotting organisms which attack wheat, so should not be sown as a first crop before wheat in a successive cropping programme. Barley is less affected than wheat by root rot but attack can still severely affect the crop. In root rot prone areas sowing barley after resistant crops such as oats or linseed is advisable. Barley as a second crop following barley should be avoided particularly where the first crop is moderately diseased.

Where barley is grown for malting grain production a rotation involving barley as the second or third crop is often desirable. On fertile clover ley land for example this will mean that fertility is reduced for the malting barley crop so the likelihood of excessive grain protein is diminished. With feed barley yield and quality should benefit when the crop is grown as an initial crop on ley land.

BARLEY QUALITY

By J. A. PARISH, Cereal Products Adviser

Plumpness and absence of pinched grain are desirable for both malting and feed barley.

Staining

A common fault in barley which detracts from its value both for malting and feed is the occurrence of weather staining. In most instances of heavy weather staining there are obvious signs of discolouration consisting of fungal threads or spores (mould). In some unusual cases mould can develop without any obvious signs of "staining".

In all cases rain or moist atmospheric conditions provide the environment under which staining and/or mould development

Skinned grains. To minimise skinning the threshing action of the harvesting machine must be less violent than for wheat
occur. All common varieties are susceptible and no control is known but observations of experiments and crops indicate that some escape may be obtained by late planting so that crops mature at a time when rain and moist atmospheric conditions are less common. In some parts of our high rainfall areas barley growers will have to accept that they cannot expect to regularly grow barley free of weather staining and mould.

In deciding on planting times farmers must consider the need to plant sufficiently early to obtain plump grain against the risk of weather damage by rain at the end of the season.

**Malting barley**

For the maltster it is essential that kernels germinate evenly and therefore freedom from skinning is important. A low nitrogen content is also an important requirement for malting barley.

In a time when production of two row barley can be expected to increase rapidly it is doubtful how much financial advantage will be obtained from attempting to produce manufacturing or malting grade barley. However, it will be an advantage to the local trade and to our prospective export trade if low protein two row barley can be produced. In order to do this farmers should avoid the following situations under which high protein barley would be grown.

- The area east of the 13-inch rainfall isohyet.
- The first crop after a period under clover.
- Heavy clay or clay-loam soils.
- The application of nitrogen fertiliser at rates higher than those recommended. Nitrogen should not be applied later than three weeks after seeding.

To minimise skinning it is necessary to adjust the harvesting machine so that the threshing action is less violent than it is for wheat. More space has to be given between the beaters and the concave and the speed of the machine may have to be reduced. Frequent inspection of the sample is essential and the necessary adjustments can only be determined by the operator. The need for adjustments during the day arises because the amount of skinning changes with temperature and humidity variations during the day. Growers with little experience of adjustments required for barley harvesting should consult their local machinery agent.

The environment in W.A. is suitable for the production of malting barley and provided growers observe the precautions suggested above, they should be able to grow a good quality malting barley. There are some prospects of overseas sales for good quality malting barley. Only one
variety is now recommended and received in bulk for manufacturing grade so that growers who wish to deliver manufacturing grade should plant only the variety "Dampier".

Feed barley

Some of the quality factors for feed barley are a little different from those for malting purposes.

Low protein level is not required and it is usually an advantage to have a higher protein level. For feed purposes, it is desirable to have a low level of fibre or husk. However, price is probably the first consideration for all purchasers of feed barley.

"Beecher" is the recommended variety and it is desirable to avoid other varieties so that a comparatively uniform sample can be provided for buyers.

The most common faults leading to rejection of barley are staining, skinning, excess screenings and mould.

Quality standards

Receival standards used by Co-operative Bulk Handling Ltd. last season for two row manufacturing (or malting) grade and standard six row barley are set down below.

MANUFACTURING GRADE 2-ROW BARLEY—

Is of the current season and is dry and mature. Moisture content not over 12 per cent.

It weighs not less than 42 lb. to the Imperial bushel, is of the Dampier variety.

Shall not be—

Tainted, musty or heavily weather stained.

Shall not include kernels that are—

Pickled, sprouted, immature or mould affected.

Shall not include more than—

7½ lb. per Imperial Bushel of screenings, 20 per cent. of skinned or broken kernels, 1 per cent. of smutted grains.

Shall not contain an admixture of more than—

1 lb. to the Imperial Bushel of foreign material.

1 per cent. of ball smut.

5 per cent. of other varieties or types of barley.

1 doublegee to the pint.

Shall not contain any admixture of—

Green immature material, sticks, stones, earth or grain insects.

STANDARD SIX-ROW BARLEY—

(a) Is of the current season and is dry and mature. (Moisture content not over 12 per cent.).

(b) Weighs not less than 42 lb. to the Imperial bushel.

And contains

(c) Not more than—

(i) 3 lb. per Imperial bushel of foreign material.

(ii) 4 lb. per Imperial bushel of screenings.

(iii) 1 per cent. of ball smut.

(iv) 1 per cent. of smut grain.

(v) 3 per cent. of blue kernels.

(vi) 1 doublegee to the chondrometer bucket.

(d) No sprouted, pickled, musty, tainted, weevily, or heavily weather stained grain, nor any sticks, stones, earth or grain insects, nor grain which shows mould spores.

(e) 6 row barley which is lightly weather stained will be received without dock. Medium weather stained barley may be received at a dockage of 3 cents per bushel, provided it is not sub-standard for any other reason.