Relationships between water use, yield and grain size of barley II. grain size

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Grains must be larger than 40 mg for barley to be accepted into malting grade. To ensure this, malting barley has traditionally been grown in reliable rainfall areas. Low-input agronomic management has been used to reduce vegetative growth and so ensure adequate water is available for grain filling. The previous paper in this series discussed the yield penalty that such low input strategies might incur. This paper considers the effect on grain size of growing barley in lower rainfall areas, which has expanded in recent years, and quantifies the effect on grain size of restricting early water use in order to increase post-anthesis water use.

Methods

The experiments were conducted in the field in 1985 and 1986, using a mobile shelter to exclude rain. The experiments are described elsewhere (1).

Results and discussion

With cv Schooner in 1985, grain size fell from 47 mg to 36.5 mg as water use (WU) declined from 300 mm to 120 mm. In treatments where the total WU was approximately the same (175-180 mm), but the ratio of post-anthesis to total water use increased from 0.11 to 0.21, grain size increased only slightly (2 mg). This required a saving in pre-anthesis WU of 20 mm.

In 1986, grain size in both O'Connor and Schooner fell with declining water use, showing that reduced grain size is an inevitable consequence of growing barley in dry areas (Fig. la). In treatments in which WU varied little (175-185 mm) but the pattern of water use varied greatly, the size of O'Connor grains fell steadily below their potential size (i.e. when water non-limiting) of 48 mg as post-anthesis WU declined below 0.35 of total WU (Fig. 2b). With Schooner, grain weight was maintained at the potential grain size (45 mg) down to 0.20 of total WU. This genotypic difference, if confirmed, would be a useful character for maintaining large grain size in dry springs.

These results show that a change in the pattern of water use can help to maintain large grains, confirming in principle the low-input agronomy used by farmers. However, the scope for manipulation may be small, as in 1985, and the use of excessively low inputs appears to have led to needlessly low yields (1). Our data suggest that agronomic strategies which increase total water use should increase yield (1) and not reduce grain size. Because of the limited scope for manipulating grain size agronomically it appears that plant selection is justified for large grains and perhaps stable size, as mentioned above.

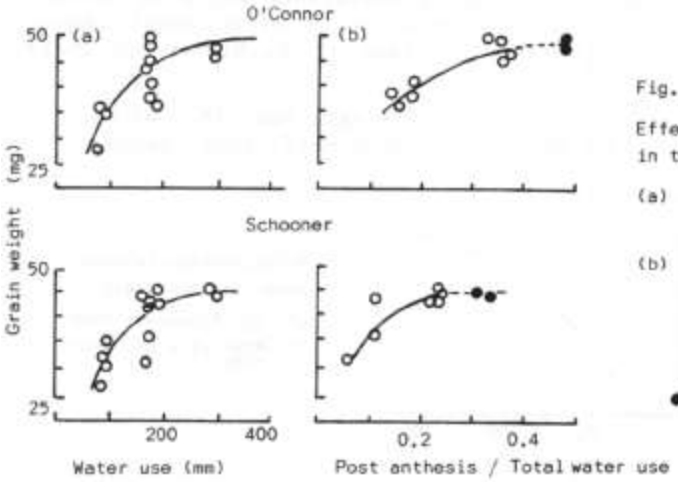

Fig. 1.

Effects of water use on grain size in two cultivars of barley.

(a) The effect of total water use on grain size.

(b) The effect of seasonal pattern of water use on grain size (data for 175-185 mm total water use only).

● water non-limiting.

1. P.S. Cornish, B.J. Read and P. Lockley (1987). Proc. 4th Australian Agronomy Conference, Melbourne.