Responses of wheat varieties to vernalization and daylength

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The broad aim of this work with wheat is to assess the potential of wheat in the high rainfall zone of Australia. This is a region of generally low farm incomes and almost complete dependence on grazing enterprises. Varieties have not been selected specifically for any part of it so our first step has been to screen for time of flowering since this is likely to be of critical importance. Initial interest has been concentrated on the coolest regions where highest yields are likely (1).

Methods

A range of overseas and Austrlian wheat varieties was screened in a glasshouse for flowering responses to vernalization (6 weeks at 1-2 deg. C following germination) and long (16h) days, using the procedure described by Syme (2).

Results and Discussion

Flowering of overseas wheat varieties was accelerated by up to 100 days through either vernalization or long days. Within that limit, virtually all response levels were found. Australian wheats covered the same range of responses to photoperiod, varying from 0 (Sunset) to 100 days (Currawa), but, of the 66 varieties examined, only a recognized winter wheat, Isis, (80 days) and Oxley (39 days) had responses to vernalization greater than 26 days. Thus most Australian wheats have little flowering response to low temperatures and they vary widely in their daylength response. A different conclusion by Syme (2) may be attributed to his restricted sample of seven varieties, including one of our rare winter wheats.

This screening allowed the identification of a sample of 24 wheat genotypes that covered the entire measured range of responses to vernalization and daylength. These were sown in March 1981 near Bombala, a relatively cold part of the high-rainfall zone.

Vernalization response then controlled floral behaviour: ear development began 3 weeks after sowing in some of the low vernalizations selections, including some with high daylength responses, and within 8 weeks in all of them. Wheats with a strong vernalization response began to develop ears between 16 and 22 weeks after sowing.

The significance of the differences between low and high vernalization responses, i.e. 'spring' and 'winter' wheats respectively, lies in the vulnerability of wheat to severe frosts. The vegetative apex is least affected by these, but the developing ear is keenly sensitive if some degree of stem elongation has occurred (3): in the present study ears 10 cm or more above ground at the time of a severe frost were killed, so only spring wheats were affected.

Other things being equal, high wheat yields are associated with long growth periods. In cold parts of Australia, only winter wheats are likely to survive winter frosts unscathed following early sowings. High yields therefore depend on the production of suitable winter genotypes. Unfortunately, these have not been a major target for Australian wheat breeders.

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3. Single W.V. 1975. In Australian Field Crops. 1. Ed. A. Lazenby and E.M. Matheson. Angus and Robertson 364-83.