

Winter wheats - towards clarifying current confusion

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Traditionally, wheats are classified as being of 'spring' or 'winter' habit, intermediate types sometimes being referred to as 'facultative'. Doubtless the designations arose from the usual season of sowing. However, in North America the terms 'winter' and 'spring' may be used to categorise certain market grade requirements. Moreover, in regions of Mediterranean climate (e.g. Australia), spring wheats are commonly sown in early winter and early growth may proceed in short days with temperatures sufficiently low to fulfil the vernalisation requirements of 'facultative' cultivars and perhaps those of some 'winter' cultivars too.

Studies of the genetic content of vernalisation responses provide a genotype basis for classification, superior to the traditional phenotypic one which so often finds expression in the genotype-environment interaction. In classification by genotype, the true 'spring' wheats would be those carrying the major gene Vrn 1 which totally dispenses with cold requirement for flowering. This inhibitor of winter habit is located on chromosome 5A and is epistatic to other inhibitory genes which are frequently associated with Vrn 1

The second group - 'facultative' wheats - may carry one or other of three major genes inhibiting winter habit - Vrn 2, Vrn 3 (located on chromosome 5D) or Vrn 4. All three permit some response to cold temperature vernalization and the requirement is usually met over a two to three-week period.

The third group of 'winter' wheats carry the recessive alleles vrn 1, vrn 2, vrn 3 and vrn 4, but because of a wide range of cold requirements (ranging from four to ten weeks) it would seem that multiple alleles at these four loci would influence their vernalization requirements. Further studies in this area are urgently needed. Clearly this proposed classification must be subject to further examination, as has been undertaken by Gotoh (1) in Japan. Gotoh has accepted the author's approach and grouped Japanese wheats into two classes differing from each other in carrying either Vrn 1 or Vrn 3 respectively.

In an attempt to assist our thinking on the nature of development patterns in wheat we should differentiate between day-length and vernalization responsiveness and, in regard to the latter, we might consider abandoning the terms 'winter', 'spring' and 'facultative' with others associated with the season of the year.

Following the above it is proposed that the bread wheats be designated thus:

Vernal wheats, unresponsive to vernalization and bearing the major gene Vrn 1 (formerly 'spring' wheats).

Semi-vernal wheats, with a positive but small response to vernalization, lacking Vrn 1 but bearing one or other of the major genes Vrn 2, Vrn 3 or Vrn 4 (formerly 'facultative').

Non-vernal wheats, with a strong vernalization requirement and bearing the recessive alleles vrn 1, vrn 2, vrn 3 and vrn 4 (formerly 'winter' wheats).

The theoretical basis of this classification led to the selection of the winter cultivar "Phoenix", released jointly by University of Melbourne and University of California.

1. Gotoh, T. 1976. Jap. J. of Breeding 26: 307-327.