

On defining a 'Winter Wheat'

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The traditional definition of 'winter' wheat was a simple one - it was a wheat that was sown before winter. Other wheat was called 'spring' wheat because it was sown in the spring (1). Confusion as to the meaning of 'winter' wheat arose in countries with mild winters, such as Australia, where European 'spring' wheats grew best when sown in the autumn.

In order to clarify the definition of 'winter' wheat, a survey was sent to wheat breeding institutions in 28 countries thought to breed winter wheat. They were asked how they would define a 'winter' wheat.

Twenty-nine wheat breeders and scientists representing 27 countries responded. Every continent was represented and a wide range of growth seasons for 'winter' wheat revealed large climatic variations both within and between countries. Some correspondents felt they had a good working definition of a 'winter' wheat at least for their local conditions but many commented on the confusion that existed.

There appears to be four ways of defining 'winter' wheat.

A local definition (the customary definition): whereby a 'winter' wheat is a wheat sown before winter in comparison with a 'spring' wheat sown in the spring or an 'alternative' wheat which can be sown at either time.

A phenological definition: Whereby a 'winter-type' wheat is one possessing a strong vernalization requirement compared with a 'intermediate-type' which has some response to vernalization and a 'spring-type' which does not respond when vernalized at 0-5°C. Seven of the 29 correspondents mentioned response to photoperiod as a criteria for defining a 'winter-type' of wheat. However, to avoid confusion, it is recommended that photoperiod response be excluded from the definition.

A physiological definition: Whereby a wheat with a 'winter habit' has a long vegetative period, prostrate growth and freezing resistance beyond that found in a wheat with an 'intermediate habit' or 'spring habit'. This definition is important in countries experiencing cold winters.

A genetic definition: Whereby a 'genetically winter' wheat has only recessive alleles at all *Vrn* loci compared with a 'genetically semi-winter wheat' which lacks *Vrn*₁ but possesses at least one other dominant inhibitor of vernalization response, and a 'genetically spring' wheat which possesses the dominant *Vrn*₁ allele (2). 1

Each of these categories of definition is valid under specific conditions but only the genetic definition is entirely objective and internationally consistent. Test crossing with wheats possessing known complements of *Vrn* alleles is the surest method of classifying a wheat. However, a 'genetically spring' wheat is distinguishable from a 'genetically semi-winter wheat' in that it does not respond to vernalization at 0-5°C. Both are distinguishable from a 'genetically winter' wheat because if a 'genetically winter' wheat is grown under sufficiently long days and temperatures above 10°C, it will head very late and in field sowings, it will head erratically.

It is recommended that the genetic definition of 'winter' wheat be adopted by the scientific community whenever possible. This can be achieved if experimenters studying the phenology or physiology of winter habit use near-isogenic *Vrn* lines such as those bred by Albert Pugsley (the 'Triple Dirk' series) or wheat varieties with a know complement of *Vrn* alleles as their experimental material. Scientific results can then be related to 'genetically spring', 'genetically semi-winter' or 'genetically winter' wheats.

1. Gassner, G. 1918. *Z. Botan.* 10 419-30.

2. Pugsley, A.T. 1983. *Euphytica* 32 743-8.