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OATS

SECTION 4

PLANT GROWTH AND PHYSIOLOGY

DORMANCY AFFECTING GERMINATION AND EMERGENCE | PLANT GROWTH STAGES

February 2016

Plant growth and physiology

4.1   Dormancy affecting germination and emergence

The dormant period is generally short in oats — from a few days to several weeks.

4.2   Plant growth stages

A growth stage key provides farmers, advisers and researchers with a common reference for describing the crop's development. Management by growth stage is critical to optimise returns from inputs such as N, plant growth regulator, fungicides and water.

4.2.1   Zadoks Cereal Growth Stage Key

This is the most commonly used key to growth stages for cereals, in which the development of the cereal plant is divided into 10 distinct development phases covering 100 individual growth stages. Individual growth stages are denoted by the prefix GS (growth stage) or Z (Zadoks), for example, GS39 or Z39.

The principal Zadoks growth stages (Figure 3) used in relation to disease control and N management are those from the start of stem elongation through to early flowering: GS30–GS61.
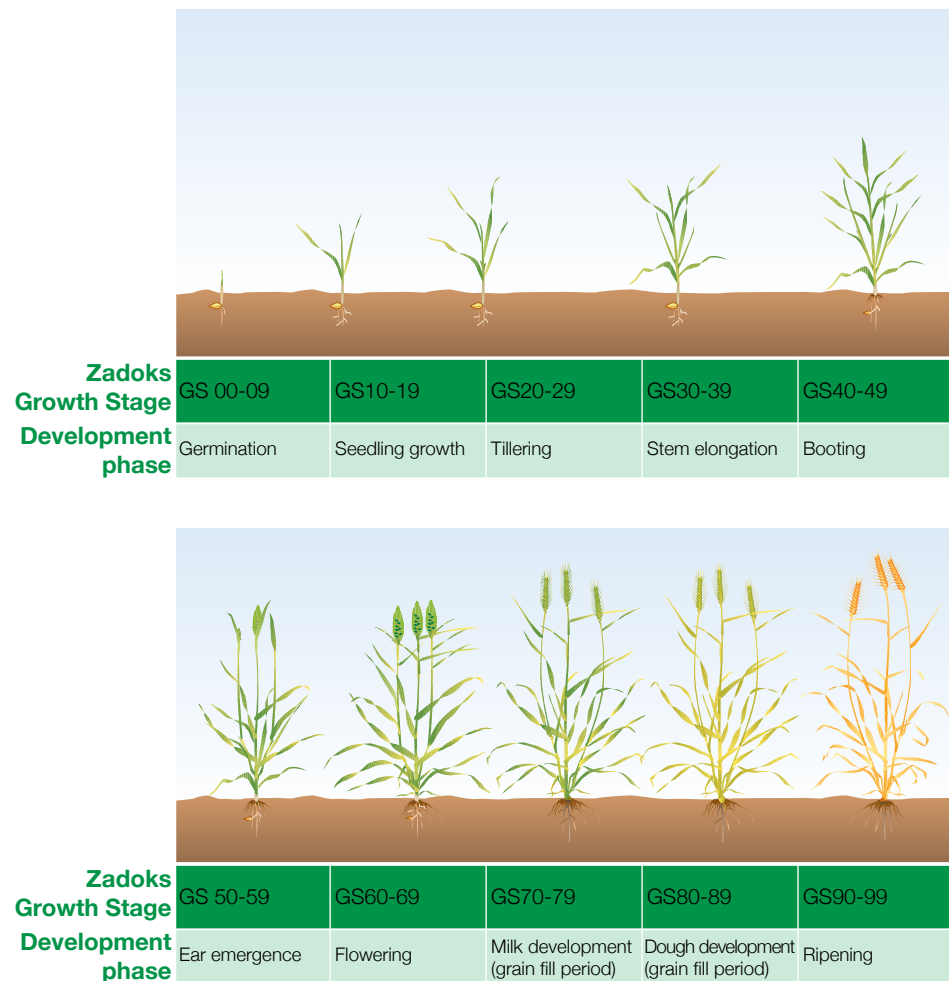
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Zadoks Growth Stage	GS 00-09	GS10-19	GS20-29	GS30-39	GS40-49
Development phase	Germination	Seedling growth	Tillering	Stem elongation	Booting

Zadoks Growth Stage	GS 50-59	GS60-69	GS70-79	GS80-89	GS90-99
Development phase	Ear emergence	Flowering	Milk development (grain fill period)	Dough development (grain fill period)	Ripening

Figure 1:   Zadoks growth stages

Early stem elongation GS30–GS33 (pseudostem erect–third node on the main stem)

This period is important for both timing of N application and protection of key leaves. In order to ensure the correct identification of these growth stages, plant stems are cut longitudinally, so that internal movement of the nodes (joints in the stem) and lengths of internodes (hollow cavities in the stem) can be measured.

Leaf dissection at GS32 and GS33

This is a method for determining which leaves are emerging from the main stem prior to the emergence of the flag leaf. Knowing which leaves are present is critical if fungicide use is to be optimised to protect leaves.

The Zadoks Cereal Growth Stage Key does not run chronologically from GS00 to GS99; for example, when the crop reaches three fully unfolded leaves (GS13), it begins to tiller (GS20) before it has completed four, five and six fully unfolded leaves (GS14, GS15, GS16).

It is easier to assess main stem and number of tillers than it is the number of leaves (due to leaf senescence) during tillering. The plant growth stage is determined by main stem and number of tillers per plant; for example, GS22 is main stem plus two tillers and GS29 is main stem plus nine or more tillers.

In Australian cereal crops, plants rarely reach GS29 before the main stem starts to stem elongate (GS30). Because of growth stages overlapping, it is possible to describe a plant with several growth stages at the same point in time. For example, a cereal plant

at GS32 (second node on the main stem) with three tillers and seven leaves on the main stem would be at GS32, 23, 17, yet practically would be regarded as GS32, since this describes the most advanced stage of development.

Note: After stem elongation (GS30), the growth stage describes the stage of the main stem; it is not an average of all the tillers. This is particularly important with timing fungicide; for example, GS39 is full flag leaf on the main stem, meaning that not all flag leaves in the crop will be fully emerged. [1]

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[1]   N Poole (2005) Cereal growth stages guide. Grains Research and Development Corporation, http://www.grdc.com.au/uploads/documents/GRDC%20Cereal%20Growth%20Stages%20Guide1.pdf

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