Key Developmental Stages of Winter Wheat, 
*Triticum aestivum*¹

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Winter wheat, *Triticum aestivum*, is important as both a forage and grain crop in the central and southern Great Plains of the United States. A simpler system of describing winter wheat developmental stages than those currently being used is needed. Ten key developmental stages are described: 1) germination and emergence, 2) tillering, 3) leaves strongly erect, 4) node formation, 5) boot, 6) heading, 7) flowering, 8) grain filling, 9) ripening, and 10) maturity. All stages can be visually identified in the field with a minimum of training and are important with respect to grazing management, fertilizer applications, pest control, forage yield, and grain harvesting. Often no time factors can be placed on the occurrence of these stages due to environmental and cultivar differences. A discussion of stress influences on grain and forage yield is included.

In much of the Great Plains, winter wheat (*Triticum aestivum* L.) is utilized as both a forage and grain crop. Identification of key developmental stages is essential in managing wheat with respect to timing of fertilizer and pesticide application, grazing, and forage or grain harvest.

Growth stages for various crop species have been identified and are frequently cited in the literature. Hanway (1963), described 11 growth stages in corn (*Zea mays* L.) that could be visually identified in the field. Similar work on grain sorghum (*Sorghum bicolor* (L.) Moench) was later reported by Vanderlip and Reeves (1972) who described 10 distinct growth stages for the species ranging from emergence to physiological maturity. Soybeans (*Glycine max* (L.) Merr.) have also been characterized with respect to their developmental stages (Hanway and Thompson, 1967).

The Feekes scale for growth stages in cereals is one of the more frequently quoted scales in describing wheat plant development (Feekes, 1941; Large, 1954). Jensen and Lund (1971) also reported a general method of defining growth stages in cereals. A quantitative system of wheat growth stages was later presented by Haun (1973). Recently Waldren and Flowerday (1979), described 11 developmental stages in winter wheat and the distribution of dry matter, N, P, and K relative to these stages.

We propose 10 key developmental stages in winter wheat that can be easily identified and directly relate to management for maximum forage and/or grain yield (Fig. 1). Other scales separate the life cycle of wheat into more development stages than are necessary for most production and research. The purpose of this report is to describe these stages and explain their significance as applied to grain and forage production in the central and southern Great Plains (Table 1). No

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attempt was made to place a time element (days after planting) on their occurrence
due to the influence of environmental factors and cultivar variation.

**STAGE 1. GERMINATION AND EMERGENCE (FIG. 2)**

This stage begins with imbibition of water by the kernel and continues until all
its stored nutrients are exhausted by the juvenile plant. Rapid growth of the

**TABLE 1. CHARACTERISTICS OF DEVELOPMENTAL STAGES IN WINTER WHEAT.**

<table>
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<th>Stage</th>
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| 1.    | Germination and emergence  
       | Coleoptile of the plant becomes visible. Only 1 primary culm is present. |
| 2.    | Tillering  
       | Tillers are visible. |
| 3.    | Leaf strongly erect  
       | Leaves strongly erect. Pseudo-stem present. |
| 4.    | Node formation  
       | Tillers begin elongating. Nodes can be felt near base of main culms. |
| 5.    | Boot  
       | Flag leaf is fully extended. Tops of spikes on main culm may be visible. Sheaths of flag leaves are enlarged. |
| 6.    | Heading  
       | Spikes (heads) are visible above flag leaf collar and peduncles continue to elongate. |
| 7.    | Flowering  
       | Spikes are fully extended. Anthers protrude from the glume and pollination is evident. |
| 8.    | Grain filling  
       | Spike, flag leaf and stem are green. Lower leaves begin to yellow and die. |
| 9.    | Ripening  
       | Grain is firm but difficult to remove from the spike. Leaves have senesced and peduncle begins to yellow. |
| 10.   | Maturity  
       | Kernels separate easily from the spike and are hard. |