Wheat Growth and Development

Crown
Seminal Roots
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Feekes 1 Emergence. Right above the soil stops coleoptile growth. The tip of the coleoptile emerges through the tip of the growing coleorhiza. These leaves fully develop before tillering initiation. The seminal rooting system develops. The shoot forms between the seed and soil surface.

Feekes 2 Tilling initiation. Tiller buds are enclosed in a protective structure called the prophyll. If there are three leaves visible, a tiller will be formed based on the base of the first leaf. Full-formed tillers contribute more to grain yield than sprouting formed tillers. The secondary rooting system starts to develop.

Feekes 3 Continuing tillering. Primary tiller buds in the axils of the first four nodes elongate. These elongate leaves form the main stem. Secondary tiller buds may develop from the base of primary tillers. Tiller development is protected based on their sequential formation. The development of the secondary rooting system increases tremendously.

Winter dormancy. Vegetative growth stops; lowering temperatures induce winter hardness in winter wheat. Vegetative requirements range from three to six weeks of temperatures below 30 degrees Fahrenheit.

Feekes 4 Compression straining. Once requirements are met, the growing point differentiates and the embryonic head reaches the double ridge stage. Depending on the season and planting date, some tillering occurs in the spring. Genetic potential and environmental conditions determine the number of tillers on a plant. Tillers with three or more leaves are nutritionally independent from the main stem.

Feekes 5 Leaf sheaths lengthen. Flag leaf sheath lengthens until the flag leaf begins to lengthen. The pseudo-stem, a succession of leaves wrapped around each other, starts to become erect.

Feekes 6 First node of stem visible. The first node of the stem becomes visible. A result of internode elongation. Nodes are started and move up the internodes to elongate much like a telescope. Sensitivity to low temperatures increases as the developing head moves up the stem. Crop water demand increases to about 0.25 inch per day.

Feekes 7 Second node of stem visible. As the second node of the stem is formed, the next-to-last leaf is just visible. Demand for water and nutrients increases. Temperatures lower than 24 degrees Fahrenheit can damage the developing head.

Feekes 8 Last leaf just visible. The flag leaf starts to emerge from the whorl above the third or fourth node. Strong partitions of photosynthesis to the developing head. Crop water demand increases to about 0.3 inch per day.

Feekes 9 Ligule of flag leaf visible. The flag leaf is completely emerged from the whorl. Flag leaf and the next-to-last leaf combined account for 70 to 90% of the photosynthesis used for grain fill and must be protected for the plant to develop its full potential.

Feekes 10 Boot. The head is made. The flag leaf sheath gives a slender appearance. The flag leaf sheath and pedicel elongate and the developing head is pushed through the flag leaf sheath. Temperatures below 28 degrees Fahrenheit may cause damage to the developing head.

Feekes 10.1-10.5 Heading. The first spike emerges through the spikelet at Feekes 10.1. All heads are out of the sheath at Feekes 10.5. It usually takes 3 to 5 days for the head to fully emerge above the flag leaf. Temperatures below 30 degrees Fahrenheit may damage the developing head. Crop water demand can exceed 0.5 inch per day during heading through grain development.

Feekes 10.5.4 Milk ripe (rough-dough). Kernels are sufficiently mature for grain fill and must be protected for the plant to develop its full potential.

Feekes 11.1 Milky ripe (color stage). Kernels are sufficiently mature for grain fill and must be protected for the plant to develop its full potential.

Feekes 11.2 Hard dough (soft dough). During the dough stage, the kernel rapidly accumulates starch and nutrients and most of its dry weight. Material separated out of the kernel surface layer is consistency. Green color begins to fade, and kernels are soft but dry.

Feekes 11.3 Kernel hard (dough). Kernel moisture decreases from 43 to 35% during doughing, kernels achieve maximum dry weight and are physiologically mature. Kernels are hard and not difficult to disorderly break.

Feekes 11.4 Kernel ripe (soft dough). Kernel moisture decreases below 19%, 0.5% during ripening, and green plant tissue becomes brown.