The grain fill period begins with successful pollination and initiation of kernel development, and ends approximately 60 days later when the kernels are physiologically mature. During grain fill, the developing kernels will be the primary sink for concurrent photosynthate produced by the corn plant.

What this means is that the photosynthate demands of the developing kernels will take precedence over that of much of the rest of the plant. In essence, the plant will do all it can to ‘pump’ dry matter into the kernels, sometimes at the expense of the health and maintenance of other plant parts including the roots and lower stalk. A stress-free grain fill period can maximize the yield potential of a crop, while severe stress during grain fill can cause kernel abortion and lightweight grain.

Kernel development proceeds through several relatively distinct stages.

**Silking Stage (Growth Stage R1).** Some may argue whether silking should be labeled as a kernel growth stage, but nonetheless silk emergence is technically the first identifiable stage of the reproductive period. Silks remain receptive to pollen grain germination up to 10 days after silk emergence. Silk receptivity decreases rapidly after 10 days if pollination has not yet occurred. Natural senescence of silk tissue over time results in collapsed tissue that restricts continued growth of the pollen tube. Silk emergence usually occurs in close synchrony with pollen shed, so that duration of silk receptivity is normally not a concern. Failure of silks to emerge in the first place (for example, in response to silkballing or severe drought stress) does not bode well for successful pollination.

**Kernel Blister Stage (Growth Stage R2).** About 10 to 14 days after silking, the developing kernels are whitish 'blisters' on the cob and contain abundant clear fluid. The ear silks are mostly brown and drying rapidly. Some starch is beginning to accumulate in the endosperm. The radicle root, coleoptile, and first embryonic leaf have formed in the embryo by the blister stage. Severe stress can easily abort kernels at pre-blister and blister stages. Kernel moisture content is approximately 85 percent.

**Kernel Milk Stage (R3).** About 18 to 22 days after silking, the kernels are mostly yellow and contain 'milky' white fluid. The milk stage of development is the infamous 'roasting ear' stage, that stage where you will find die-hard corn aficionados standing out in their
field nibbling on these delectable morsels. Starch continues to accumulate in the endosperm. Endosperm cell division is nearly complete and continued growth is mostly due to cell expansion and starch accumulation. Severe stress can still abort kernels, although not as easily as at the blister stage. Kernel moisture content is approximately 80 percent.

**Kernel Dough Stage (R4).** About 24 to 28 days after silking, the kernel's milky inner fluid is changing to a 'doughy' consistency as starch accumulation continues in the endosperm. The shelled cob is now light red or pink. By dough stage, four embryonic leaves have formed and about 1/2 of the mature kernel dry weight is now in place. Kernel abortion is much less likely once kernels have reached early dough stage, but severe stress can continue to affect eventual yield by reducing kernel weight. Kernel moisture content is approximately 70 percent.

**Kernel Dent Stage (R5).** About 35 to 42 days after silking, all or nearly all of the kernels are denting near their crowns. The fifth (and last) embryonic leaf and lateral seminal roots form just prior to the dent stage. A distinct horizontal line appears near the dent end of the kernel and slowly progresses to the tip end of the kernel over the next 3 weeks or so. This line is called the 'milk line' and marks the boundary between the liquid (milky) and solid (starchy) areas of the maturing kernels. Severe stress can continue to limit kernel dry weight accumulation. Kernel moisture content at the beginning of the dent stage is approximately 55 percent.

**Physiological Maturity (R6).** About 55 to 65 days after silking, kernel dry weight usually reaches its maximum and kernels are said to be physiologically mature and safe from frost. Physiological maturity occurs shortly after the kernel milk line disappears and just before the kernel black layer forms at the tip of the kernels. Severe stress after physiological maturity has little effect on grain yield, unless the integrity of the stalk or ear is compromised (e.g., ECB damage or stalk rots). Kernel moisture content at physiological maturity averages 30 percent, but can vary from 25 to 40 percent grain moisture.

**Harvest Maturity.** While not strictly a stage of grain development, harvest maturity is often defined as that grain moisture content where harvest can occur with minimal kernel damage and mechanical harvest loss. Harvest maturity is usually considered to be near 25 percent grain moisture.

**Related Reference:**

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