# Wheat Maturity Time and Double-Crop Profitability

In the wheat-double-crop soybean system, soybean is planted immediately after wheat is harvested. Thus, the timing of wheat harvest directly affects the soybean planting date, which in turn affects the soybean yield. On average, during the double-crop soybean planting timeframe in Illinois, farmers can gain about 1 to 2 bushels of soybeans per acre for every two days that planting occurs earlier. This can equal roughly $10 to $20 per acre, depending on current market prices. In other words, each day that the wheat crop delays soybean planting, $5 to $10 per acre is lost. To avoid these losses, there are two key recommendations to consider: 1) harvest the wheat crop in a timely manner, and 2) select an earlier-maturing wheat variety.

## Timely Wheat Harvest

Timely wheat harvest means harvesting the crop as soon as the straw is dry enough to combine and the grain moisture level is between 13% and 20%. If the grain will not be dried after harvest, target a moisture level between 13% and 14%. Delaying wheat harvest beyond this point leads to economic losses for multiple reasons. First, as discussed, delaying wheat harvest delays double-crop soybean planting, jeopardizing the soybean yield. Second, delaying wheat harvest can severely impact wheat grain quality.

Wheat that is not harvested in a timely manner is more likely to be exposed to rainfall after the kernels have dried, leading to quality losses. When exposed to rain, dry wheat kernels can reabsorb moisture in the field, causing the starch molecules to swell. When the kernels dry again, the starch molecules shrink, leaving small voids that reduce grain density and result in lower test weight. Additionally, rainfall after maturity but prior to harvest can trigger pre-harvest sprouting in which the kernels begin to germinate. Enzyme activity within the kernel leads to the breakdown of starch. This lowers yield, test weight, and falling number. The falling number is a measure of the kernel enzyme activity. A low falling number indicates high enzyme activity, which is bad for quality. Purchasers of wheat use test weight and sometimes falling number to assess quality and impose discounts that penalize reduced quality. This can have a major impact on the profitability of the wheat crop. A timely wheat harvest can help growers avoid these price discounts and enable earlier soybean planting.

## Signs Wheat Harvest is Near

Knowing when the wheat crop is mature is the first step towards achieving a timely wheat harvest. Maturity in wheat refers to either physiological maturity or harvest maturity. Physiological maturity is the point in time when grain filling has stopped, and wheat kernels no longer gain weight. Grain moisture at this point will be between 30% and 50% (Clarke, 1983). Approximately 3 to 4 days later, harvest maturity occurs. Harvest maturity is the point in time when the crop is ready to be harvested.

Monitoring the development of the wheat crop as it approaches maturity is key to getting wheat taken off the field at the ideal time to protect grain quality and to enable timely double-crop soybean planting. Understanding the key growth stages leading up to harvest helps with monitoring. In wheat, the Feekes scale is used for numbering growth stages. Feekes 11 is the final growth phase leading up to harvest. During this period, grain filling and grain ripening occur in a series of stages with recognizable characteristics upon close inspection, as shown in Table 1.

An important indicator of maturity is the color and stiffness of the peduncle (Chapman et al. 2021), which is the stem right below the wheat head, as shown in Figure 1. At physiological

maturity, peduncles lose their green color, and the kernels reach the hard dough stage, in which the kernels feel firm when squeezed. Within approximately three days, the peduncles will become stiff, and the crop may be at harvest maturity.

Once the peduncles are neon green or neon yellow as seen in Figure 1, spikes B and C. The crop should be checked every 2 to 3 days to detect harvest maturity. Look for stiff, straw-colored peduncles and hard-feeling kernels, as seen in Figure 1, spike D. As soon as these signs are visible, check if the grain moisture is appropriate for harvest. Beware that in some varieties, the lower canopy might remain green even when the kernels are ripe. Thus, stepping into the field to check the peduncle and kernel characteristics is recommended.


Fig. 1. Wheat spikes and peduncles showing the progressive color changes associated with maturation. (A) Peduncle mostly green with the first signs of yellowing. (B) Neon green peduncle. (C) Neon yellow peduncle. (D) Straw-colored peduncle. Photo by Jessica Rutkoski, University of Illinois Urbana-Champaign.

## Table 1: Final Wheat Growth Stages and Their Recognizable Characteristics

| Stage of Kernel Development | Recognizable Characteristics | Processes Occuring in Kernels |
|---|---|---|
| Milky | Plant tissues start to turn yellow, and kernels fill with a milky liquid. | Grain Filling and Moisture Loss |
| Mealy | Most plant tissues continue to yellow. When kernels are squeezed between the index finger and thumb, they feel soft and exude a dry or pasty material. | Grain Filling and Moisture Loss |
| Hard Dough | Kernels feel firm when squeezed. The stem right below the head, called the peduncle, turns completely yellow (like peduncle C in Figure 1). However, the peduncle is not yet stiff. By the end of this stage, grain moisture content drops to about 30 to 50%. | Grain Filling and Moisture Loss |
| Ripe | Kernels are hard. Peduncles are straw color and are stiff (like peduncle D in Figure 1). Kernel moisture ranges from 14-25%. Leaves and whole stems are also usually straw color and stiff. Sometimes plant tissues remain green for a few days after kernels are ripe. | Moisture Loss |

## Selecting an Early-Maturing Wheat Variety

While a timely wheat harvest is fundamental for maintaining the profitability of wheat-double-crop soybeans, selecting an earlier wheat variety can also help. Among commercial wheat varieties available in Illinois, there is about an 11-day range in maturity dates. Maturity is classified into categories: ultra early, very early, early, medium early, medium, and medium-late. Between maturity classes, there is roughly a two-day difference in maturity dates as shown in Table 2. This variation in maturities means that growers can potentially shift wheat harvest and double-crop soybean planting by more than one week by switching from a medium-late to an ultra-early variety.

Regardless of maturity class, it is also important to consider yield and other important traits. As with most crops, later-maturing varieties tend to yield more than earlier ones unless heat or drought stress occurs during grain-filling. Aside from yield, scab resistance and test weight are other important traits to look for in a variety. Fortunately, early-maturing wheat varieties often have slightly higher test weights.

When selecting a very-early or ultra-early wheat variety, there is a greater possibility that freeze events during March and April will inflict damage on the wheat crop. This is especially true for certain varieties that joint early. In wheat, reproductive growth begins with a phase called jointing, which is when a true stem has formed and begins elongating. Once jointing begins, hard freezes are damaging to the crop (Lindsey et al. 2021). Varieties that joint early are at a greater risk of freeze damage. Sometimes, very early or ultra-early maturity comes with early jointing, but this is not always true.

Many winter wheat varieties adapted to Illinois have mechanisms that sense the day length and the duration of winter temperatures. These mechanisms help prevent jointing from occurring too early. Recommendations include avoiding early jointing varieties to reduce the risk of freeze damage. Jointing time and maturity timing are somewhat independent traits.

## Practical Advice for Selecting Early Wheat Varieties

Deciding on a wheat maturity class can be difficult, given the many tradeoffs to consider. A few strategies can help. First, if possible, plant more than one maturity group. In some years, early wheat varieties yield very well, and in other years, they yield less than later varieties. By having more than one maturity group, producers can better ensure that every year will be a good year for at least one of the varieties. Furthermore, having more than one maturity group can facilitate a timely harvest. Harvest can begin with the earlier variety and end with the later one. Second, try progressively earlier varieties over the years until satisfied with the results. For example, producers currently growing a medium-maturing variety may wish to transition gradually by planting a medium-early variety the following year, followed by an early variety one or two years later. For those new to the wheat-double-crop soybean system, it may be better to start with a very early wheat variety first to increase the chance of success with the double-crop soybeans.

## Table 2: Maturity Timing Between Maturity Classes of Wheat in Illinois

| Maturity date, in days after the earliest variety | Maturity category |
|---|---|
| 0-1 | Ultra Early (UE) |
| 2-3 | Very Early (VE) |
| 4-5 | Early (E) |
| 6-7 | Medium Early (ME) |
| 8-9 | Medium (M) |
| 10-11 | Medium Late (ML) |

Finally, it is important to keep in mind that results vary from year to year and variety to variety. If a grower tries an earlier wheat variety and it performs poorly, it's worth trying again next year, possibly with a different variety of the same maturity class. Review official wheat variety testing results to help inform variety selection decisions for a specific operation.

## Sources


Clarke, J.M. 1983. Time of Physiological Maturity and Post-Physiological Maturity Drying Rates in Wheat 1 . Crop Sci. 23(6). doi.org/10.2135/cropsci1983.0011183X002300060041xDigital Object Identifier (DOI)

Chapman, E.A., S. Orford, J. Lage, and S. Griffiths. 2021. Capturing and Selecting Senescence Variation in Wheat. Front. Plant Sci. 12. doi.org/10.3389/fpls.2021.638738

Lindsey, L.E., D.S. Alt, and A.J. Lindsey. 2021. Freeze symptoms and associated yield loss in soft red winter wheat. Crop, Forage and Turfgrass Management 7(1): e20078. doi.org/10.1002/cft2.20078


## Author


Jessica Rutkoski, Associate Professor and Wheat Breeder, Crop Sciences, University of Illinois Urbana-Champaign



Modified July 2026