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Identifying Soybean Growth Stages

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Accurate identification of soybean growth stages is important to maximize grain yield and profitability, because most management decisions are based upon the growth stage of soybean plants within the fields. Two plant growth habits exist for soybean: indeterminate and determinate. Indeterminate cultivars can produce both vegetative and reproductive growth simultaneously until about R5 growth stage. Most indeterminate cultivars are maturity groups 00 to IV. In contrast, determinate cultivars will complete most of its vegetative growth prior to initiating reproduction. Most determinate cultivars are maturity groups V to IX.

Soybean growth stages are divided into two phases: vegetative (V) and reproductive (R) (Table 1). When identifying **vegetative** growth stages of soybean (figures 1 to 5), the primary consideration is the number of fully developed leaves on the main stem. A fully developed leaf is one that has all leaflets open (Figure 4), while an undeveloped leaf has leaflet edges that are still touching (figures 2 and 3). **Reproductive** growth stages (figures 6 to 13) are identified by specific flower, pod, and seed characteristics.

When classifying a field of soybean as a specific growth stage, *at least 50 percent* of the plants in the field must be at or beyond that growth stage. For example, a soybean field that has 10 percent of the plants with two fully developed trifoliate leaves (V2), 60 percent of the plants with three fully developed trifoliate leaves (V3), and 30 percent of the plants with four fully developed trifoliate leaves (V4) will be the V3 growth stage. This is because 70 percent of the field is or has already been the V3 growth stage.

Key features of soybean growth stages are highlighted within this guide. For a comprehensive description of soybean growth and development refer to *Soybean Growth and Development* from Iowa State University Extension (http://extension.agron.iastate.edu/soybean/production_growthstages.html).

Table 1. Key soybean growth stages, approximate timing, descriptions, and importance for Kentucky soybean production.

Growth Stage (50% or more of field)		Typical Timing in Kentucky		Description/Importance
		Full-Season	Double-Crop	
Vegetative Stages				
VE	Emergence	early to mid May	mid June to early July	The cotyledons and growing point are above the soil surface.
				Full-season soybean typically emerge 1 to 2 weeks after planting.
				Double-crop soybean typically emerge 5 days after planting.
VC	Cotyledon	May	June/July	The two unifoliate leaves are fully developed (the leaf edges are no longer touching).
				Nitrogen (N)-fixing (Bradyrhizobium japonicum) root nodules may be visible, but not functional.
V1	1 Trifoliate Leaf	May	June/July	The first trifoliate leaf is fully developed.
				N-fixing root nodules may be visible, but not functional.
V2	2 Trifoliate Leaves	May/June	June/July	Two trifoliate leaves are fully developed.
				N-fixing root nodules are typically functional.
V3	3 Trifoliate Leaves	June	July	Three trifoliate leaves are fully developed.
				Typically occurs 2-3 weeks after emergence for full-season soybean and 2 weeks after emergence for double-crop soybean.
				This is final growth stage when several herbicides can be applied.
V4 to V(n)	4 Trifoliate Leaves to nth Trifoliate Leaves	June/July	July	Four to nth trifoliate leaves are fully developed.
				The number of trifoliate leaves is determined by variety and environmental conditions.
Reproductive Stages				
R1	Beginning Flowering	late June to mid July	early Aug	One flower at any node on the main stem is open.
				Environmental stress or plant injury typically has minimal effect on grain yield.
R2	Full Flowering	July	Aug	A flower on the main stem opens at one of the two top nodes with a fully developed trifoliate leaf.
				Beginning of rapid growth and nutrient accumulation in vegetative plant parts.
				Environmental stress or plant injury typically has minimal effect on grain yield.
R3	Beginning Pod	mid July to Aug	Aug	A 5 mm (3/16 inch) long pod on the main stem at one of the four top nodes with a fully developed trifoliate leaf.
				Environmental stress or plant injury typically has minimal effect on grain yield at this stage.
				Typically last pesticide applications occur.
R4	Full Pod	early Aug	Aug	A 2 cm (3/4 inch) long pod is on the main stem at one of the four top nodes of a fully developed trifoliate leaf.
				Beginning with this growth stage, grain yield can be greatly reduced due to environmental stress and/or plant injury.
R5	Beginning Seed	Aug	late Aug	A 3 mm (1/8 inch) long pod is on the main stem at one of the four top nodes that has a fully developed trifoliate leaf.
				Begins a period of rapid seed growth and fill.
				Plant stress at this stage typically results in aborted seed.
				Environmental stress and/or plant injury can result in significant yield reductions.
R6	Full Seed	early Sept	Sept	Green seed fill the pod cavity at one of the four top nodes on the main stem with a fully developed trifoliate leaf.
				Plant stress at this stage typically results in pod and seed abortion, which can significantly reduce yields.
R7	Beginning Maturity	Sept	late Sept to Oct	One normal pod on the main stem is mature and has turned brown or tan.
				Soybean seed has essentially reached physiologic maturity, which means the seed has attained maximum dry weight.
				Rapid leaf yellowing begins.
				Stress that occurs at this stage has essentially no effect on grain yield.
R8	Full Maturity	mid Sept to Oct	late Oct to Nov	95% of pods have turned brown (mature pod color).
				Stressful conditions at this stage have no effect on grain yield, unless hail or other factors that remove pods from the stem.

Vegetative Growth Stages

Figure 1. Soybean plants at VE growth stage. The cotyledons (bean) of the plant in the foreground are separating to expose the developing unifoliate leaflets. The plant in the background is often referred to as "poking through": The stem (hypocotyl) and part of the bean are visible.

Figure 2. Soybean plant at cotyledon (VC) growth stage. The two unifoliate leaves are fully developed while the first trifoliate leaf is not fully developed: Leaflet edges are still touching.

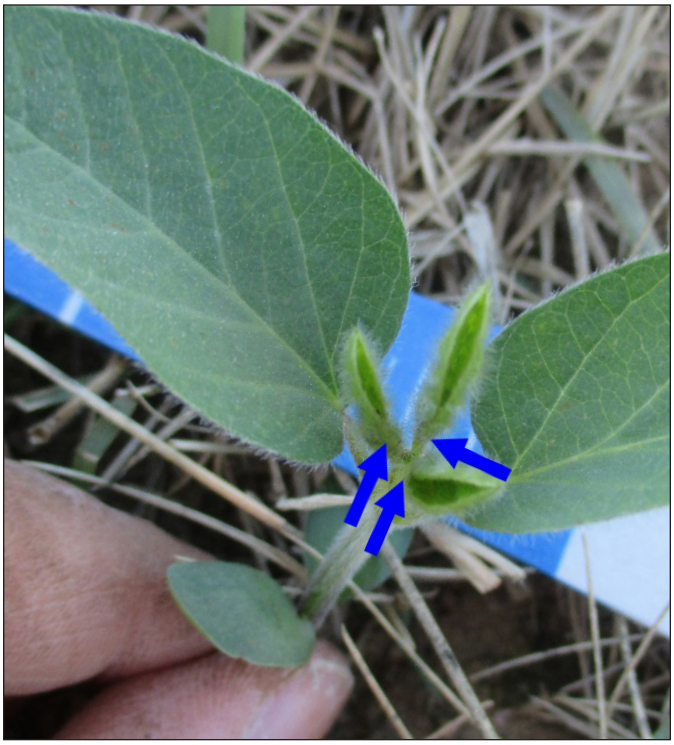

Figure 3. Soybean plant at cotyledon (VC) growth stage. The first trifoliate leaf has begun to open, however the leaflet edges are still touching near the stem of the plant (blue arrows) and therefore are not considered fully developed.

Figure 4. Soybean plant at V1 growth stage.

Figure 5. Soybean plant at V3 growth stage. Three trifoliate leaves are fully developed.

Figure 6. Soybean plant at R1 growth stage—beginning flowering, with one flower open (blue arrow) anywhere on the main stem. The open flower is at the seventh node.

Figure 7. Soybean plant at R2 growth stage—full flowering, with an open flower on the main stem at one of the top two nodes with a fully developed trifoliate leaf. The open flower (blue arrow) is at the second node from the top on the main stem.

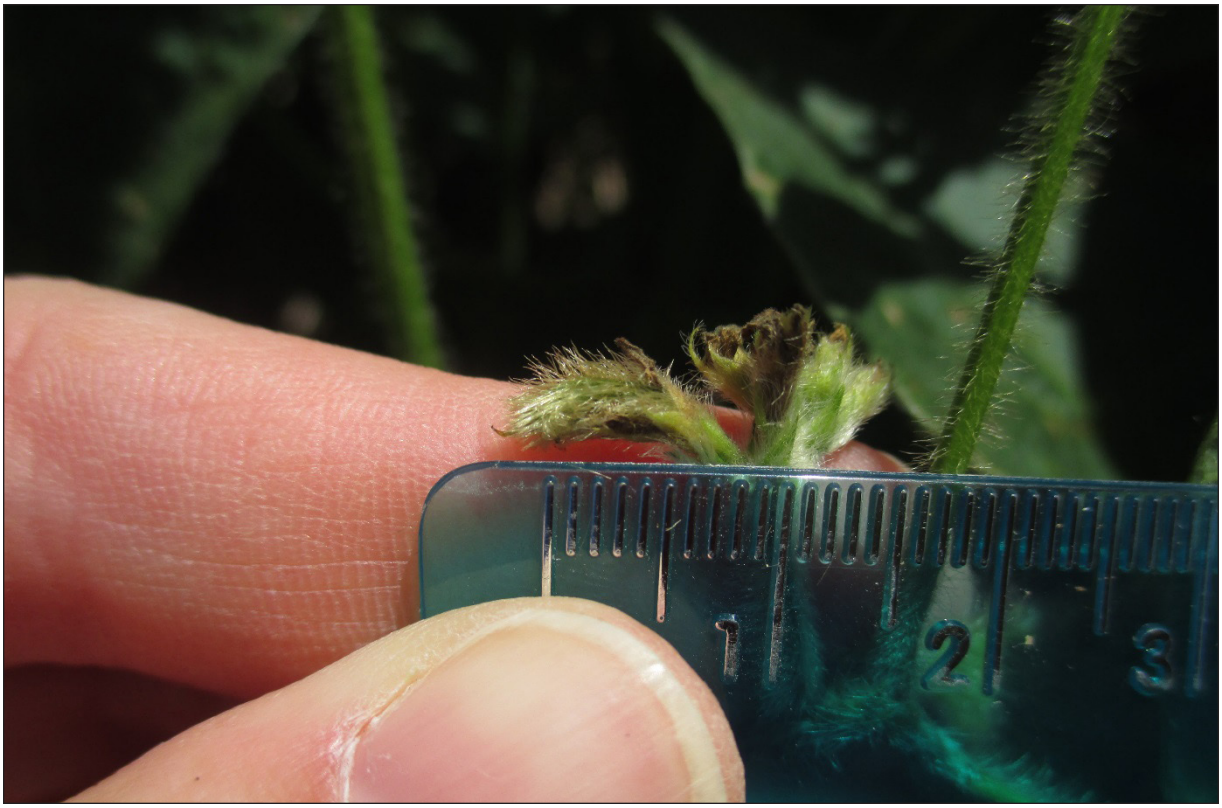

Figure 8. Soybean pod is approximately 5 mm (3/16 inch) long. Soybean plants are at R3 growth stage when a 5 mm pod is at one of the top four nodes of the main stem.

Figure 9. Soybean pod is approximately 2 cm (3/4 inch) long. Soybean plants are at R4 growth stage when a 2 cm pod is at one of the top four nodes of the main stem.

Figure 10. Soybean pod with seed that is approximately 3 mm long. Soybean plants with a 3 mm long seed at one of the top four nodes of the main stem are at R5 growth stage.

Figure 11. Soybean pod with green seed filling the pod cavity. The R6 growth stage occurs when green seed fill the pod cavity at one of the top four nodes on the main stem.

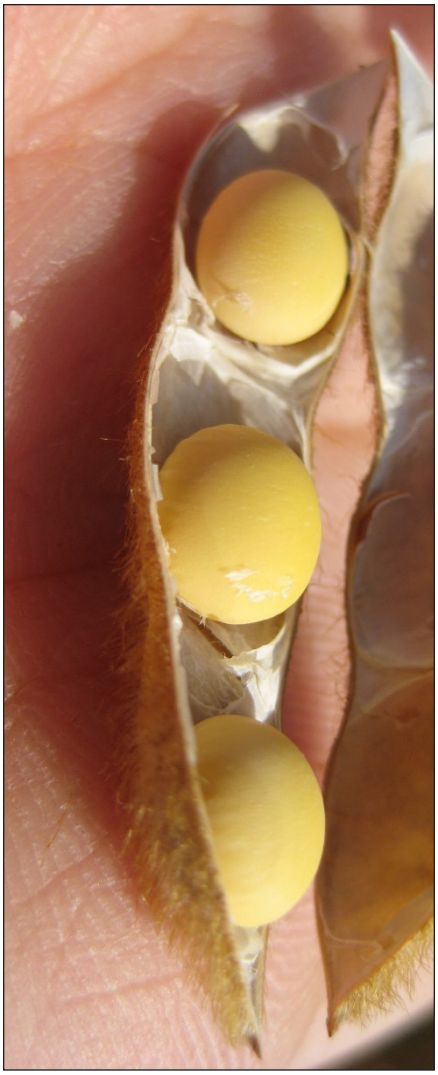

Figure 12. Soybean seed and pod at R8 growth stage.

Figure 13. Soybean plants at R8 growth stage.

Resources

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