



SOYBEAN



GROWTH STAGES AND MANAGEMENT TIPS



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The growth of soybean plants consists of **vegetative** and **reproductive** stages. The vegetative stages begin with emergence and are described by the development of the cotyledons and leaves. The reproductive stages begin with the onset of flowering and are described by the development of the flowers, pods and seeds. It is important to correctly stage soybean fields to make correct and timely applications including pesticides, fertilizers and irrigation. Due to various reasons (e.g., uneven emergence), the plants in a field can be at different growth stages at the same time. **At least 50%** of the plants in a field should have reached at least a certain growth stage for the field to be considered at that growth stage.

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PLANTING SOYBEAN SEED

Management Tips

- **Apply soil-test-based recommended granular/dry fertilizer** at or before planting. More information on soil testing and analysis can be found at the LSU AgCenter [Soil Testing and Plant Analysis Lab](#).
- **Plant approximately 1 to 2 inches deep** into moisture. Good seed-to-soil contact is important to help establish a good stand. Soybean seeds need to imbibe approximately 50% of their body weight in water to germinate.
- Soybean plants are susceptible to multiple seed rot and/or seedling diseases, including nematodes, if conditions are conducive. **Fungicide and nematicide seed treatments** or in-furrow applications at planting may be beneficial.
- **Pre-plant burndown and pre-emergent herbicides** should be applied to help maintain weed-free fields until canopies fully lap.
- **Insecticidal seed treatments (IST)** against early-season insect pests are important when planting occurs in suboptimal conditions (e.g., weedy fields, historically high pressure of insect pests, early or late planting, etc.). IST products are generally effective in soybean for around 30 days.

GERMINATION

Management Tip

- Soybean seeds are susceptible to soil temperatures at or below approximately 50 F during the first 24-48 hours after planting when the seed is rapidly imbibing water. **The optimum soil temperature for germination is 60-70 F.** For soil moisture, 50% moisture content is optimum. When the seed germinates, the radicle (primary root) begins to elongate downward and the hypocotyl (stem below the cotyledons) begins to elongate upward in a hook-shape while pulling the cotyledons toward the surface (**Figures 1 and 2**).

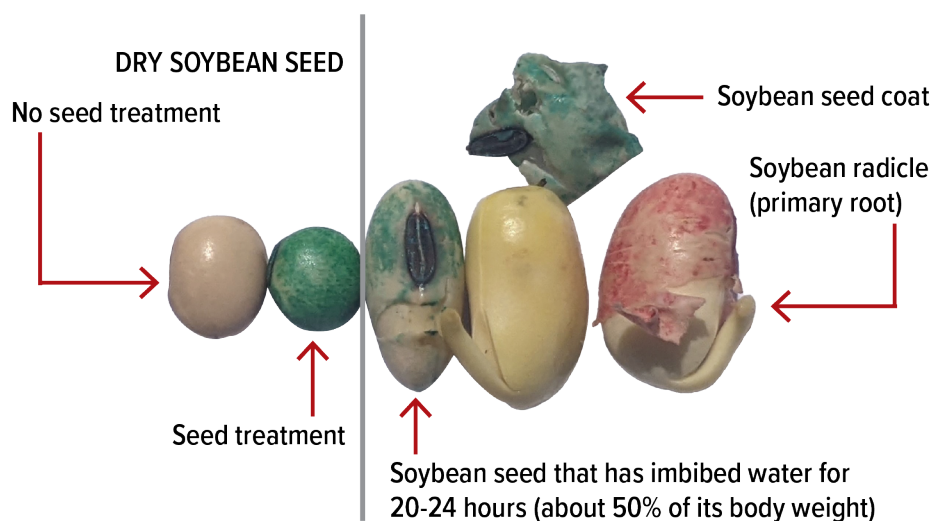


Figure 1. Soybean seed can be planted with or without a seed treatment. At optimum temperatures, soybean seed will germinate and initiate growth of the radicle (root) after imbibing approximately 50% of its body weight in water within approximately 24-48 hours.

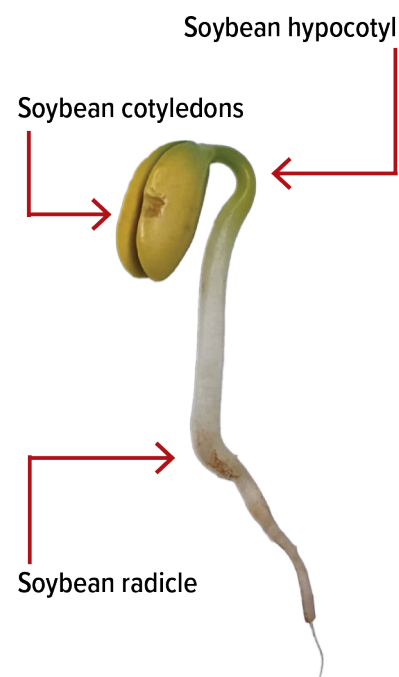


Figure 2. A soybean seedling prior to emergence. The radicle has continued to grow downward. The hypocotyl grows upward while pulling the cotyledons past the soil surface.

VE GROWTH STAGE

The cotyledons emerge past the soil surface (**Figure 3**).

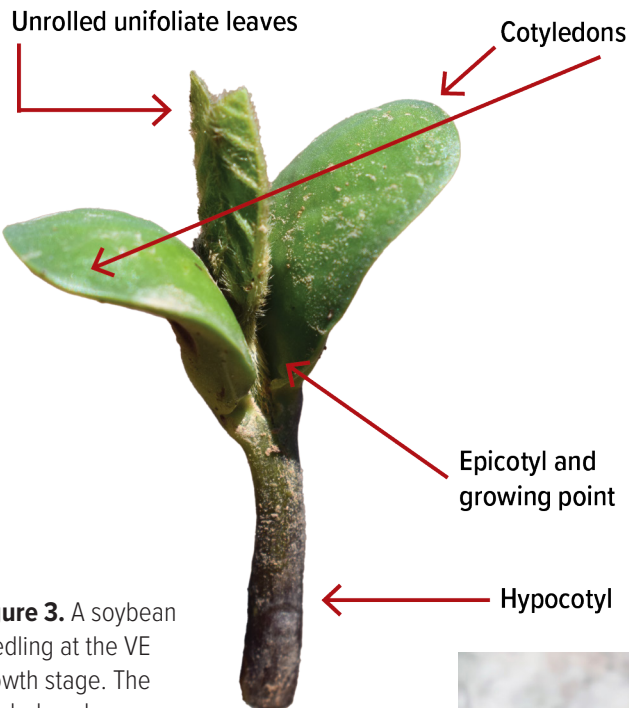


Figure 3. A soybean seedling at the VE growth stage. The cotyledons have emerged past the soil surface, but the unifoliate leaves are still unrolled.

Management Tips

- **It is important for seedlings to emerge before the soil forms a hard crust on the surface.** Watch the weather forecast to see if there is a forecasted rain before the expected emergence date. If the soil crusts over before emergence, the cotyledons (and growth point) can break away from the hypocotyl (**Figure 4**). If the growing point breaks off, there will be no new growth from the plant.
- **Post-emergent herbicides should be applied** to help maintain weed-free fields until the canopy fully laps.



Figure 4. A soybean seedling's hypocotyl broke below the cotyledons. In this case, the growing point has broken off and the plant will not continue to grow.

VC GROWTH STAGE

The first true leaves (unifoliolate, also called unifoliate) completely unroll, and the edges do not touch (**Figure 5**).



Figure 5. A soybean plant at the VC growth stage where the unifoliate leaves have unrolled.

Management Tip

- If the main stem breaks above the cotyledons, axillary branches can grow from the cotyledon node or any node above the cotyledons (**Figures 6 and 7**).



Figure 6. A soybean plant's epicotyl and growing point broke above the cotyledons. Although the main stem broke, axillary branches have begun growing from the cotyledon node.



Figure 7. Soybean plant that has two axillary branches that have replaced the original main stem.

V1 GROWTH STAGE

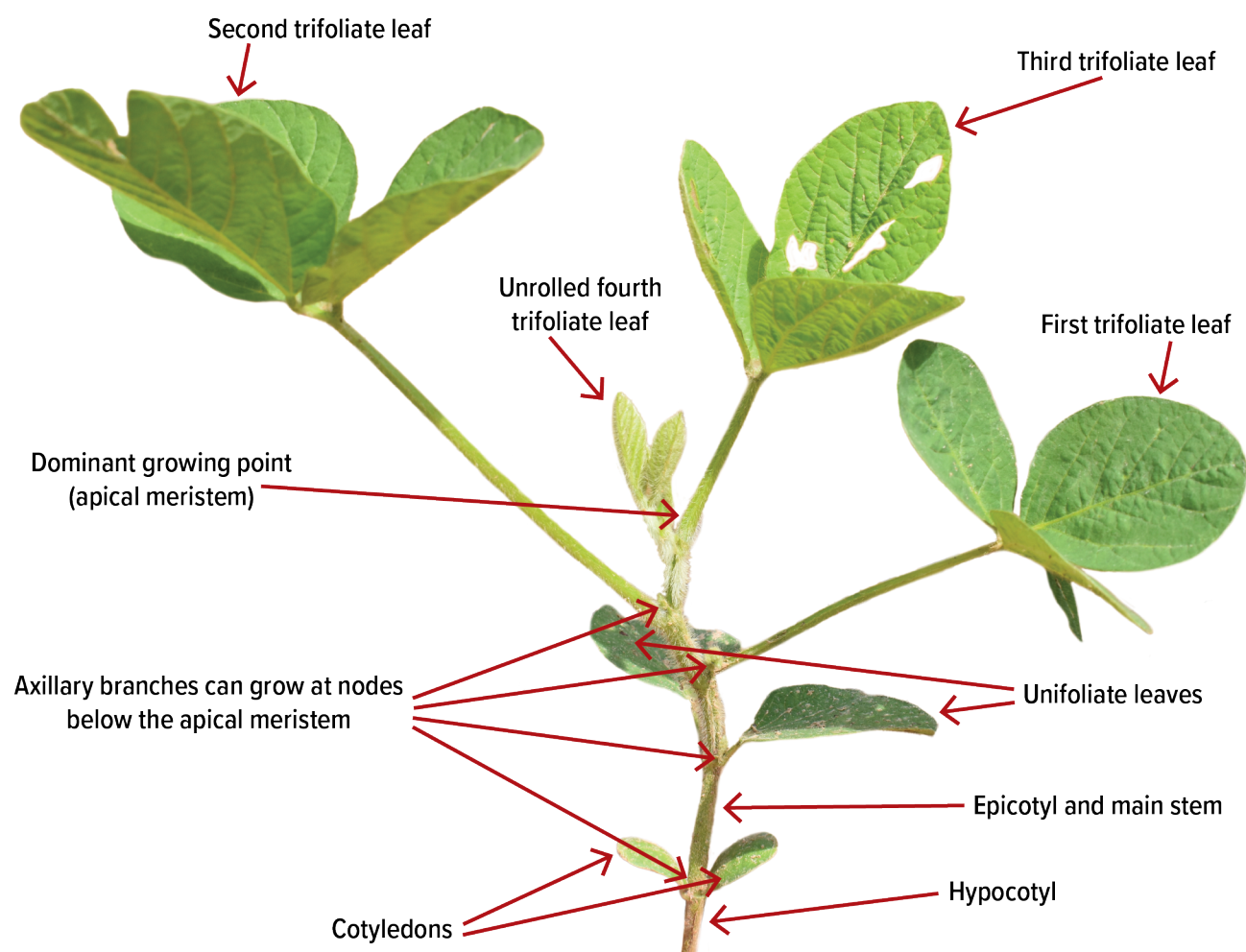
The first trifoliolate (also called trifoliate) leaf completely unrolls and the edges do not touch.

Management Tips

- V1 to Vx can be determined by **counting the number of open trifoliolate leaves** on the main stem.
- Take **stand counts** to determine if repair-planting or replanting is necessary.

V3-Vx GROWTH STAGES

The third trifoliolate leaf completely unrolls and the edges do not touch, etc. (Figure 8).



5 P3888 **Figure 8.** A soybean plant at the V3 growth stage. The third trifoliolate leaf has unrolled, but the fourth trifoliolate leaf is still unrolled.

V3-Vx GROWTH STAGES

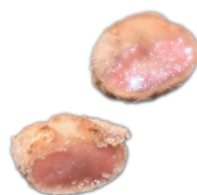
Management Tip

- Watch for *Bradyrhizobium japonicum* **nodules to form on the roots** beginning at the V1 growth stage. The nodules should be active (have a red or pink cross section) by the V2-V3 growth stages (**Figures 9 and 10**).



Figure 9. *Bradyrhizobium* bacteria nodules form on soybean roots at different growth stages. The top left picture shows nodules beginning to form on a plant at the V1 growth stage. The top right picture shows nodules at the V3 growth stage, and the bottom right picture shows nodules at the R5 growth stage.

Figure 10. A cross-section of a *Bradyrhizobium* nodule. A nodule with a pink or red cross section indicates the nodule is actively fixing nitrogen.



REPRODUCTIVE STAGES — FLOWERING

(R1 and R2: Evaluated either on **any main** stem node or on one of the **two uppermost** main stem nodes.)

R1 GROWTH STAGE

A flower opens **anywhere** on the main stem (Figure 11).



Figure 11. Soybean plants that have a flower open on the main stem. Depending on the variety, soybean flowers will be either purple or white.

Management Tips

- Indeterminate soybean varieties will begin to **flower** at approximately the V5-V7 growth stage.
- It is important to maintain **weed-free fields** until R1 to prevent yield loss from competition. After R1, the primary issue of weeds becomes a reduction in harvest efficiency.
- Maintain adequate **soil moisture** throughout the reproductive growth stages, beginning at R1. If unseasonably dry conditions exist, irrigation may be necessary prior to R1.
- Scout for **lepidopteran insect pests** (loopers, green cloverworm, velvetbean caterpillar, and podworm). Treat at thresholds. Once soybean reaches R6.5, protection from loopers is no longer critical.
- Start scouting for **stinkbugs**. The critical period of protection is pod and seed development. However, in situations where the population is extremely high prior to the critical period, treatment may be warranted.

R2 GROWTH STAGE

A flower opens at one of the **two uppermost** nodes on the main stem that contains a fully developed trifoliate leaf (Figure 12).



Figure 12. Soybean plants at the R2 growth stage where a flower opens at one of the two uppermost nodes on the main stem that contains a fully developed trifoliate leaf.

Management Tips

- **Tissue sample** for monitoring/diagnosing nutritional status/deficiency particularly for potassium (K). The LSU AgCenter recommends taking the trifoliate, without the petiole (the stem connecting the trifoliate to the main stem), from the third node beginning at the top of the plant. It is good to take a trifoliate from 25 random plants that represent the entire field.
- In-season **fertilizer applications** should be based on pre-plant soil tests and in-season tissue test results. Potassium can be applied up to the R4 growth stage to reduce yield loss from deficiency. However, a soil-test-based pre-plant application can be more effective than an in-season application.

REPRODUCTIVE STAGES — POD AND SEED DEVELOPMENT

(R3-R6: Evaluated from one of the **top four** nodes which contain a fully developed trifoliate leaf.)

R3 GROWTH STAGE

At least one pod that measures 3/16 of an inch (**Figure 13**).



Figure 13. The development of soybean pods from the R3 growth stage to maturity.

Management Tips

- Apply fungicides **if necessary**. In most years, soybean fields will not require multiple fungicide applications. In some years, no fungicide is required to preserve yield loss due to disease. Check labels, as pre-harvest intervals vary with [products](#).
- Regular scouting for stinkbugs, particularly **redbanded stink bugs**, should be conducted. Treat at thresholds. Protect soybean from redbanded stink bugs until harvest. Caution should be taken to consider the pre-harvest intervals and the maximum annual rate of chemicals applied. See the article "[Protect Soybeans From Redbanded Stinkbugs Until Maturity](#)" from the LSU AgCenter.

R4 GROWTH STAGE

At least one pod that measures 3/4 of an inch (**Figure 13**).

Management Tips

- Apply fungicides **if necessary**.
- Last stage to apply **dry/granular fertilizer** applications for correcting deficiencies.

R5 GROWTH STAGE

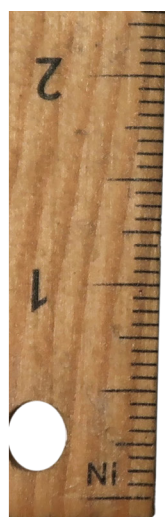
At least one seed that measures 1/8 of an inch (**Figures 14 and 15**).



Management Tips

- Apply fungicides **if necessary**.
- If root-knot **nematodes** are present in the soil, galling symptoms may be visible on the roots. It is important to not mistake nodulation with galling (**Figure 16**).

Figure 14. A soybean pod with seed that measures approximately 1/8 of an inch. The white pod membrane still covers the seed in the middle and right positions.



Approximate R6.0 pod:
Green seeds fill the pod
cavity with the protective
membrane still attached.

R6.5 pod: Seed margins are clearly defined as the
protective membrane has separated from the seed.

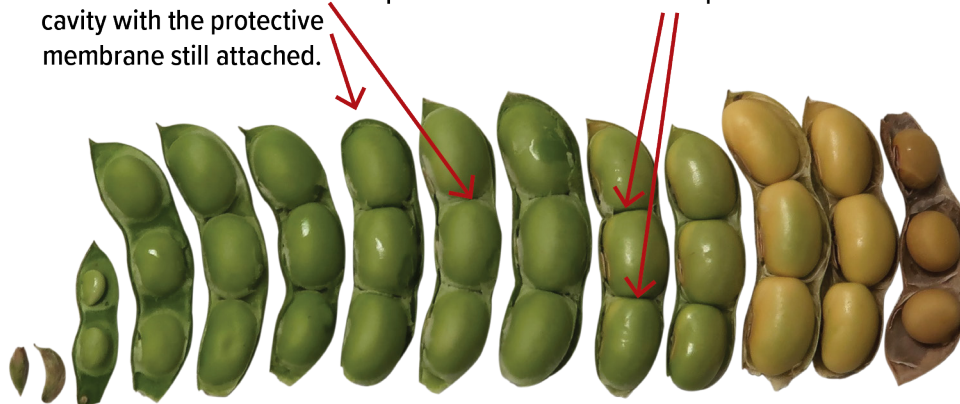


Figure 15. The development of soybean seed from approximately the R5 growth stage to maturity. The seed in this picture corresponds to the pods in Figure 13.



Figure 16. Soybean roots with root-knot nematode galls forming. Unlike *Bradyrhizobium* nodules, Root-knot galls are not easily pulled off the root.

GROWTH STAGES

R6

At least one pod with green seed that fills the pod cavity (**Figure 15**).

Management Tips

- Maximum **nutrient uptake** occurs.
- Maximum **dry matter accumulation** occurs between R6 and R6.5 stages.
- Fungicides are **not recommended** after R6.

R6.5

All pods have reached R6.5 where seed is separating from the white membrane (**Figure 15**). All pods must reach the R6.5 growth stage before the maximum potential of dry matter has been accumulated. When the pod reaches the R6.5 stage, the pod color likely has begun turning yellow (**Figures 13 and 15**).

Management Tip

- **Irrigation** can be terminated without losing dry matter if adequate soil moisture is present to ensure there is no decline in yield as all seeds mature.

R7

At least one pod located **anywhere** on the main stem that has matured in color (**Figure 17**). Depending on the variety, the mature color of the pod can be either tan or brown and can have either gray or tawny pubescence.



Figure 17. Soybean plants with different color pods and pubescence. The mature color of soybean pods can be either tan or brown and can have either gray or tawny pubescence.

R8

When 95% of pods have matured in color.

Management Tips

- Proper **harvest timing** cannot be determined by the appearance of mature pods. The seed must still dry down to approximately 13% moisture before harvesting.
- Collect **soil samples** for a nematode assay within two weeks (before the nematode count begins to decline) after harvest for future consideration of control methods. More information on nematodes and sampling can be found at the LSU AgCenter [Nematode Advisory Service website](#).



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