SOYBEAN GROWTH AND DEVELOPMENT

MANAGING A SOYBEAN CROP THROUGH GROWTH STAGES

How soybeans grow and develop plays an important role in managing the crop. Since a soybean plant's vegetative and reproductive growth stages occur for several weeks, many environmental conditions can affect final yield. For example, too much or too little moisture at specific stages can affect performance. The information below can help you determine the proper timing of various management practices.

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VEGETATIVE STAGES

EMERGENCE — VE

During the germination and emergence process, when the cotyledon pokes through the soil, primary and lateral root growth begins. Functional root hairs develop shortly after planting. Root hairs are essential to nutrient uptake and water absorption at this early stage.

Management Practices: Scout for proper emergence; check final stand and uniformity. Optimum seed placement varies from 1-2 inches. Deeper (>2-inch) planting depth and cooler soil temperatures jeopardizes final emergence. If stand is poor, replanting may be needed.

COTYLEDON — VC

Unifoliate leaves expand (leaf edges are not touching). The cotyledons are the main nutrient reservoir for young soybean plants (7 to 10 days old). Damaged cotyledons can lower yields.

Management Practices: Scout for proper emergence. Weed control is important before and after soybeans emerge. If the stand is poor, replanting may be needed.

FIRST TRIFOLIOLATE — V1

Trifoliate leaf unrolls (fully developed leaves at the unifoliate nodes). The plant becomes self-sustaining as newly developed leaves carry out photosynthesis. From this point onward, new nodes will appear every 3 to 5 days until V5 stage (five-node stage), and then every 2 to 3 days until the last vegetative node.

Management Practices: Scout for early-season weeds, insects and diseases.

SECOND TRIFOLIOLATE — V2

Two trifoliates unroll (fully developed trifoliate leaf at the node above the unifoliate nodes). Check for proper inoculation. Nodulation has been established on the roots at this stage and nitrogen fixation continues until late reproductive stages. Effective nodulation results in higher yields and more protein when compared with non-nodulated soybean plant.

Management Practices: Scout for early-season weeds, insects and diseases.

Apply postemergence herbicides if needed. If nodulation has been established effectively, nitrogen fertilization is not recommended and if applied in large quantities it will inhibit nitrogen fixation activity.

- The third trifoliolate (V3) stage takes place when three trifoliolates are unrolled.
- The unrolling of six trifoliates indicates the V6 stage. The root system continues to grow, even expanding across 30-inch row spacing.
- The V growth stages continue as long as the plant continues to produce trifoliates. Determinate soybean plants completed most of their vegetative growth when flowering begins. Indeterminate plants produced trifoliates until the beginning of seed formation stage (late reproductive period).

REPRODUCTIVE STAGES

BEGINNING FLOWERING — R1

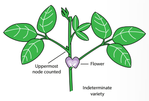
Plant has one flower open at any node on the main stem. Indeterminate plants start at the bottom and flower upward. Determinate plants start at one of the top four nodes and flower downward.

Management Practices: Scout for insects and diseases. Spray foliar insecticide or fungicide, if needed.

FULL BLOOM — R2

Soybean plant has one open flower on one of the two uppermost nodes on the main stem with a fully developed leaf.

Management Practices: Scout for insects and diseases. Spray foliar insecticide or fungicide, if needed.



BEGINNING POD — R3

Pods are 3/16-inch (5 mm) long on one of the four uppermost nodes on main stem with a fully developed leaf.

Management Practices: Scout for insects and diseases. Spray foliar insecticide or fungicide, if needed. Identify water stress, which affects pod formation. Irrigation is critical at this stage, if common practice. Late-season hail damage to the leaf area at this stage severely affects final yields.

FULL POD — R4

Pods are 3/4-inch (2 cm) long on one of the four uppermost nodes on main stem with a fully developed leaf. Almost 50% of nitrogen uptake occurs around this stage.

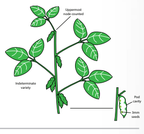
Stage R4 marks the beginning of the most crucial period of plant development in terms of yield determination.

Management Practices: Scout for insects and diseases. Late-season diseases can lower yields. Irrigation is also critical at this stage. Peak water use can reach 2.5 to 3.0 inches/day. Spray foliar insecticide or fungicide, if needed.

BEGINNING SEED — R5

Seed is 1/8-inch long (3 mm) on one of the four uppermost nodes on main stem with a fully developed leaf. Primary and lateral roots grow strong until R5. After R5, the shallower roots degenerate, but the deeper roots and laterals grow until R6.5.

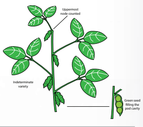
Management Practices: Scout for insects and diseases. Late-season diseases severely lower yields. Spray foliar insecticide or fungicide, if needed.



FULL SEED — R6

Pod containing a green seed that fills the pod cavity on one of the four uppermost nodes on main stem. Most nutrients have been taken up by the time the plant reaches R6 stage.

Management Practices: Scout for insects and diseases. Late-season diseases severely lower yields. Spray foliar insecticide, if needed. Late-season hail damage to the leaf area could lower yields.



BEGINNING MATURITY — R7

One pod on the main stem has reached mature pod color.

Management Practices: Scout for green stem syndrome and other issues before harvest.

FULL MATURITY — R8

Approximately 5 to 10 days before harvest, pods should reach full maturity, where 95% of pods have reached mature pod color.

Management Practices: Scout for green stem syndrome. If the plant is still green, the best option is to harvest slowly and make sure the harvesting equipment is sharp and in excellent operating condition.

Growth stages are determined for an entire field – consider a field to be in a specific growth stage only when 50 percent or more of the plants have reached that stage.

Technical editing for this poster was led by Ignacio Ciampitti, Ph.D., crop production and cropping systems professor, Kansas State University Department of Agronomy. Chart was reviewed by University of Tennessee extension researchers Ryan Blair, Ph.D., Robert Hayes, Ph.D., Angela McClure, Ph.D., Scott Stewart, Ph.D. and Heather Young-Kelly, Ph.D. for customization purposes.

Information and drawings about stages of soybean development are adapted from Fehr and Caviness (1980). Illustrations are provided as a courtesy of Kansas State University Department of Communications and Agricultural Education.