

SOYBEAN GROWTH AND DEVELOPMENT

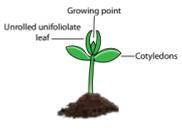
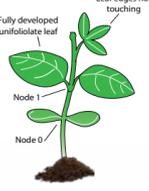
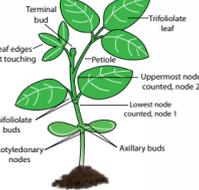


MANAGING A SOYBEAN CROP THROUGH GROWTH STAGES

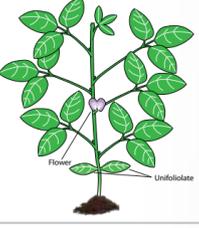
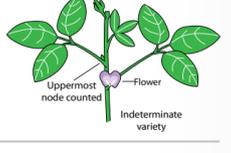
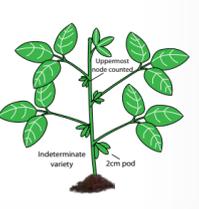
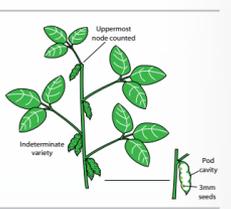
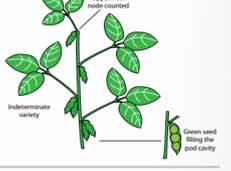
Proper management of the soybean crop requires knowledge of how environmental conditions and pests affect growth during vegetative and reproductive stages. For example, too little or too much soil moisture at certain stages may hinder growth and lower yield, and insect pests may damage the crop at one stage but not another. The information below can help you determine the proper timing of various management practices.



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 depth varies from 0.5 to 1.5 inches. Deeper (>1.5-inch) planting depth, especially when soils are cool, jeopardizes final emergence.	
COTYLEDON	VC	Unifoliolate 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 justified.	
FIRST TRIFOLIOLATE	V1	Trifoliolate leaf unrolls (fully developed leaves at the unifoliolate 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 trifoliolates unroll (fully developed trifoliolate leaf at the node above the unifoliolate nodes). 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 plants.	Management Practices: Scout for early-season weeds, insects and diseases. Check for proper inoculation. If nodulation has been established effectively, nitrogen fertilization is not recommended and, if applied in large quantities, it will inhibit nitrogen fixation activity.	
LATER VEGETATIVE STATES		<ul style="list-style-type: none"> - The third trifoliolate (V3) stage takes place when three trifoliolates are unrolled. In case of damage produced to the growing point, axillary buds will permit the soybean plants to compensate for yield or final productivity. - The unrolling of six trifoliolates 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 trifoliolates. Determinate soybean plants completed most of their vegetative growth when flowering begins. Indeterminate plants produced trifoliolates until the beginning of seed formation stage (late reproductive period) - It is important to establish 90 to 95% canopy coverage by flower and pod formation to capture the light necessary for maximum yield potential. If this is not achieved, consider methods in the future to improve leaf area development, such as earlier planting, later relative maturity, narrower rows, and/or greater seeding rates. 		

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. If kudzu bug, soybean aphid, or foliage feeders exceed economic threshold, apply insecticide.	
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. If kudzu bug, soybean aphid, or foliage feeders exceed economic threshold, apply insecticide. Water stress will result in aborted flowers. Irrigate if available and if needed.	
BEGINNING POD	R3	Pods are 3/16-inch (5 mm) long on one of the four uppermost nodes on the main stem with a fully developed leaf.	Management Practices: Scout for insects and diseases. If kudzu bug, soybean aphid, or foliage feeders exceed economic threshold, apply insecticide. Spray foliar fungicide if disease is present and if environmental conditions are conducive for future disease development. Adequate water is critical at this stage. Irrigate if needed.	
FULL POD	R4	Pods are 3/4-inch (2 cm) long on one of the four uppermost nodes on the main stem with a fully developed leaf. Almost 50% of nitrogen has been taken up by 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. If kudzu bug, soybean aphid, or foliage feeders exceed economic threshold, apply insecticide. If seed are forming on lower nodes and seed-feeding insect pests exceed economic threshold, spray insecticide. Spray foliar fungicide if disease is present and environmental conditions are conducive for future disease development. Irrigation is also critical at this stage. Peak water use can reach 2.5 to 3.0 inches/day.	
BEGINNING SEED	R5	Seed is 1/8-inch long (3 mm) on one of the four uppermost nodes on the 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. Corn earworm and stinkbugs will feed on newly forming seed and reduce yield if numbers exceed economic thresholds. Apply the appropriate insecticide if necessary.	
FULL SEED	R6	Pod contains green seed that fills the pod cavity on one of the four uppermost nodes on the main stem. Most nutrients have been taken up by the time the plant reaches R6 stage.	Management Practices: Scout for insects and diseases. Spray insecticide if insect pests exceed economic threshold.	
BEGINNING MATURITY	R7	One pod on the main stem has reached mature pod color. At R7, about 95% of the soybean yield has been set.	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 soybean 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 for customization purposes by David Holshouser, associate professor & extension agronomist, Virginia Cooperative Extension.

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

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