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Staging Soybean Development

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Extension and Outreach

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Accurate growth stage determination of soybean is essential to accurately apply pesticides and determine potential yield loss from environmental stress.

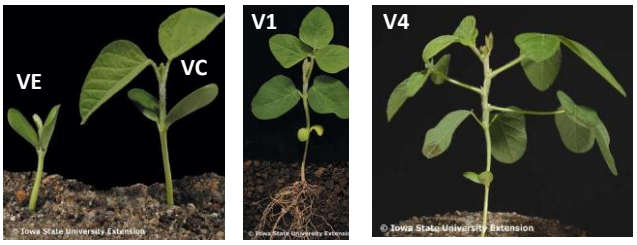
Growth, development and yield of soybeans are a result of a variety's genetics interacting with the environment (6) and management practices. Minimizing environmental and biotic stress will maximize soybean yield. Understanding how a soybean plant grows and develops and how production practices and pests (diseases, insects, and weeds) interact and influence yield can enable management practices that minimize stress and maximize yield. Management practices that influence crop growth include tillage practices, water management (irrigation or drainage tile), variety selection, seeding rate, planting date, row width, pest management, and fertilization.

The growth stage identification system in use today was first reported by Fehr and coworkers (2). It divides plant development into vegetative (V) and reproductive (R) stages. With the exception of the first two stages, the V stages are designated numerically as V1, V2, V3, etc. through V(*n*) where (*n*) represents the number for the last node. The (*n*) will fluctuate with

variety and environmental differences. The eight R stages are designated numerically.

Vegetative stages as described by Fehr and coworkers (2) are determined by counting the number of nodes on the main stem, beginning with the unilfoliolate node, which have or have had a completely unrolled leaf. A leaf is considered completely unrolled when the leaf at the node immediately above it has unrolled sufficiently so the two edges of each leaflet are no longer touching. At the terminal node on the main stem, the leaf is considered completely unrolled when the leaflets are flat and similar in appearance to older leaves on the plant.

VEGETATIVE STAGES
VE: Emergence
VC: Unrolled unifoliolate leaves
V1: First unrolled trifoliolate leaf
V2: Second unrolled trifoliolate leaf
V3: Third unrolled trifoliolate leaf
V4: Fourth unrolled trifoliolate leaf
V(*n*): "*n*", number of unrolled trifoliolate leaves



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On average, it takes 10 days from planting to emergence (VE), primarily because of the time it takes the seed to imbibe 50 percent of its weight in water to germinate and elongate the root and hypocotyl. Soybean will develop one node approximately every 5 days after emergence throughout the vegetative growth phase (i.e. VE to VC, VC to V1, etc.). However, it can take as many as 10 days between growth stages if poor environmental conditions exist. It takes much longer for the plant to transition through the reproductive stages (R1 through R8) ranging from 3 days to develop from R1 to R2 to 15 days to develop from R5 to R6 and 18 days to develop from R6 to R7 (1).

Growth stages can vary within a field; differences are generally caused by temperature (1) and biotic stress such as water stress, weed competition, nematodes, or insects (6). To stage plant development within a field, a growth stage begins when at least 50 percent of plants are at or beyond that stage (2).

ROOT GROWTH

More than 76 percent of soybean roots grow in the top 16 inches of soil with more than 50 percent growing in the top eight inches (3). Soybean rooting depth has been measured at 4.9 to 6.5 feet under normal field conditions (4, 5, 7). Under ideal conditions, soybean roots can grow downward at a rate of 0.5 inches per day from planting to R1 (1) and 2.3 inches per day from R1 to R3 (4). Downward growth continues through growth stages R5 to R6 under normal field conditions. However, downward growth after R5 appears to be variety specific (4).

REPRODUCTIVE STAGES

Bloom – R1 and R2

R1: Beginning bloom
Plants have at least one open flower at any node.

R2: Full bloom
Plants have an open flower at the node immediately below the uppermost node with a completely unrolled leaf.

Full bloom

Pod development – R3 and R4

R3: Beginning pod
Pods are 3/16 inch long at one of the four uppermost nodes on the main stem with a fully developed leaf.

R4: Full pod
Pods are 3/4 inch long at one of the four uppermost nodes on the main stem with a fully developed leaf.

Seed development – R5 and R6

R5: Beginning seed
Seeds are 1/8 inch long in the pod at one of the four uppermost nodes on the main stem.

Beginning seed

R6: Full seed
Pods contain green seeds that fill the pod to capacity at one of the four uppermost nodes on the main stem.

Full seed

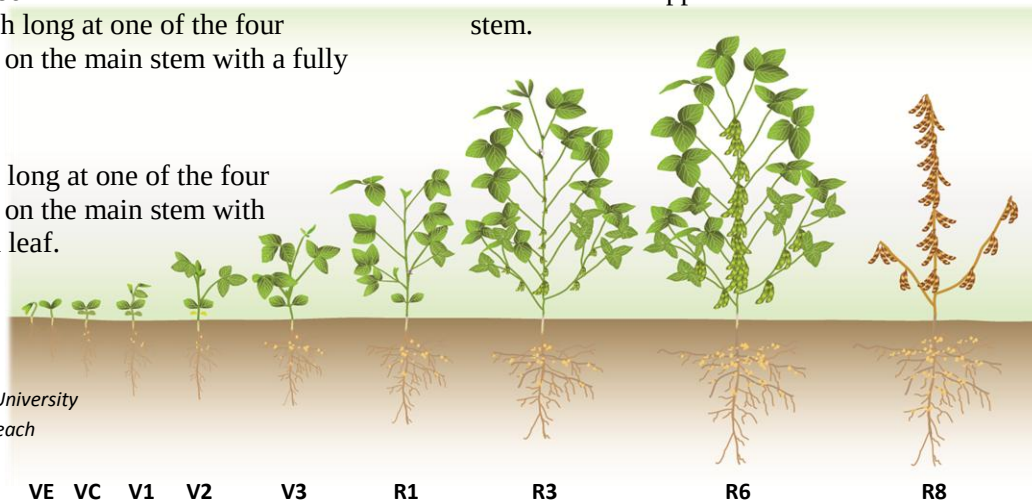

Image: Iowa State University Extension and Outreach

Seed Development, *continued*

Maturity – R7 and R8

R7: Beginning maturity
One pod on the main stem has reached its mature color (tan, brown, or black).

Beginning maturity (above)

R8: Full maturity
Ninety-five percent of the pods have reached their mature color.

Full maturity

PHOTO GALLERY

Beginning bloom

Full bloom

Beginning pod


Full pod

Prepared by David Wright and Andrew Lenssen, Department of Agronomy, Iowa State University.

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