



Agronomic Spotlight

Soybean Yield Components During R1 to R4 Growth Stages

- Accurate determination of the growth stage of a soybean crop can help optimize crop management decisions.
- Vegetative growth stages in soybean are numbered according to how many fully developed trifoliolate leaves are present.
- Soybean reproductive stages begin at flowering (R1 to R2) and include pod development (R3 to R4), seed development (R5 to R6), and plant maturity (R7 to R8).

Accurate determination of the growth stage of a soybean crop can help optimize crop management decisions. The effects of frost, hail, moisture stress, diseases, insects, and weeds, or the timing and efficacy of pesticide applications or magnitude of the impact on yield potential can be estimated by soybean growth stage when an event occurs. Vegetative growth stages in soybean are numbered according to how many fully developed trifoliolate leaves are present. The reproductive stages begin at flowering (R1-R2) and include pod development (R3-R4), seed development (R5-R6), and plant maturity (R7-R8). Growth stages can overlap. The growth stage of a crop is determined when 50% or more of the plants are in or beyond the growth stage in question.

Beginning Flowering (R1)

Soybean is a short day plant, which means they require a night longer than a specific length to initiate flowering. As nights begin to lengthen after June 20, plants from each maturity group will begin to flower when their specific maturity group's night length is reached.

Beginning flowering (R1) is a time of rapid growth. At least one flower is located on the main stem during this reproductive growth stage (Figure 1). Plants are at a vegetative stage between V7 (seven fully developed tri-foliolate leaf nodes) to V10 and 15 to 18 inches tall. Flowering always begins on the third to sixth node on the main stem, will continue up and down the main stem, and then eventually move to the branches. Soybean flowers are called racemes and are found in leaf axils. Every axil has several flowers that may



Figure 1. Soybean plant during beginning flowering (R1) growth stage. Photo courtesy of Iowa State University.

develop into a pod containing seeds. Each raceme will develop from the base to the tip. Consequently, the pods at the base of the plant are usually more mature than those at the tips. Stress, such as defoliation or root damage, that occurs during the early reproductive stages (R1 to R5.5) can affect growth rate and may have an impact on yield potential.

Full Flower (R2)

Full flower (R2), also known as full bloom, is distinguished by an open flower at one of the two uppermost nodes on the main stem (Figure 2). One or more of these upper nodes has a fully developed leaf and approximately 50% of the total number of nodes has developed. Soybean plants are in the V8 to V12 vegetative growth stage and are usually 17 to 22 inches tall at the beginning of full flower. Major lateral roots have turned downward in the soil and nitrogen (N) fixation by root nodules is increasing quickly. New flower development slows down between R2.5 to R3 with completion typically taking place by R5. Rapid accumulation of dry matter along with N, phosphorus (P) and potassium (K) is occurring and will take place until shortly after R6. The soybean plant will accumulate 25% of its total dry weight and nutrients and about 50% of its mature height during R2. The largest yield reducing stress during full flower is defoliation, which can occur from various sources including insect damage, disease, or hail. Fifty percent defoliation at this stage can reduce yield by 6%.^{1,2}



Figure 2. Soybean plant during full flower (R2) growth stage. Photo courtesy of Iowa State University.

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Beginning Pod (R3)

At the beginning pod (R3) growth stage, one of the four uppermost nodes has a pod that is 3/16 inch long (Figure 3). Soybean plants can be 23 to 32 inches tall and may be at the V11 to V17 vegetative growth stage. Stress occurring during this growth stage may affect yield potential by decreasing total pod number, bean number per pod, or seed size. Typically, soybean plants can compensate, at least partially, for temporary stress. The long flowering period contributes to the ability to compensate; however, the soybean plant loses this ability as it matures from R1 to R5.5. Typically, 60 to 75% of the flowers will abort and as many as 50% of the formed pods may abort. Stress during this reproductive stage may increase those abortion rates thus decreasing yield potential. Conversely, favorable conditions may increase pod number per plant and increase yield potential.



Figure 3. Soybean plant during beginning pod (R3) growth stage. Photo courtesy of Iowa State University.

Full Pod (R4)

At the beginning of the full pod (R4) growth stage, one of the four uppermost nodes will have a pod that is 3/4 inch long (Figure 4). Rapid pod growth and seed development take place at first, followed by finalization of pod number. Pod dry weight increases from R4 to R5 (beginning seed). This stage marks the beginning of the critical period for determining seed yield potential. Stress during R4 to R6 can cause more reduction in yield potential than at any other growth stage.¹ The most critical time during pod formation is late R4.5 to early seed fill at R5.5, as reductions in yield potential can occur from fewer pods. If needed, irrigation during this critical time may help reduce potential yield loss.



Figure 4. Soybean pods during the full pod (R4) growth stage. Photo courtesy of Iowa State University.

Management Considerations

Insecticides are an important part of integrated management of bean leaf beetle (BLB) and soybean aphid (SBA) (Figures 5 & 6). The first and second generations of BLB can occur in July and August.

Insecticide applications during the R3 to R6 stages of soybean growth can be beneficial to reduce defoliation,

pod feeding, and transmission of bean pod mottle virus (BPMV). BPMV symptoms include mottled or crinkled leaves and stunted plants (Figure 7). Multi-state research has shown that well-timed insecticide applications for SBA are most beneficial during the R1 to R5 stages of soybean growth.



Figure 5. Bean leaf beetles (note the black triangle behind the head).

Fungicide applications for late season diseases during the reproductive stages of growth can be beneficial. The optimum time of a fungicide application is dependent on the disease being treated, but typically an application during the R2 to R5 stages of growth can help prevent leaf loss and potential yield reduction.

Insect and disease situations are highly variable each season. Treatment thresholds and recommendations vary by state. Consult local experts to determine management options prior to taking action.



Figure 6. Soybean aphids.



Figure 7. Soybean leaf mottling

Sources:

¹ McWilliams, D.A., Berglund, D.R., and Endres, G.J. 2004. Soybean growth and management quick guide. Publication number A-1174. North Dakota State University Extension. www.ag.ndsu.edu. ² Hodgson, E.W., McCormack, B.P., Tilton, K., and Knodel, J.J. 2012. Management recommendations for soybean aphid (*hemiptera: aphididae*) in the United States. *Journal of integrated pest management*. 3(1). <http://lib.dr.iastate.edu>. ³ Pedersen, P. 2004. Soybean growth and development. PM 1945. Department of Agronomy. Iowa State University Extension. ⁴ Stoller, P. 2012. Growth stages of agronomic crops. Publication number X905. University of Illinois. Web sources verified 04/27/2015.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development, & Agronomy by Monsanto.

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