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Understanding Soybean Seed Growth

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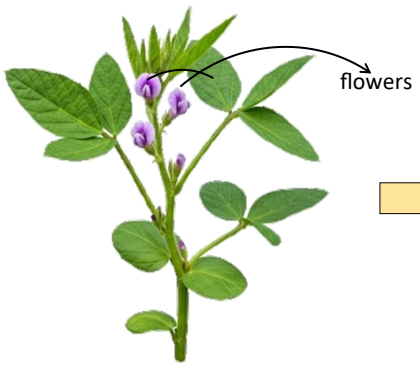
Do you know why farmers say, "August and September make a bean"? This old adage reflects a critical truth.

Among the different growth stages of soybean, the R5 stage to R7 stage is the seed-filling period, which occurs mostly from August to the end of September. These are considered critical stages when pods and seeds develop, which determine the final yield. During these stages, soybean plants direct most of their energy and nutrients into seed development, and any stresses at this critical time whether from drought, disease, or nutrient shortage can significantly reduce yields.

Understanding seed filling Phase (R5 stage)

This stage marks the completion of pod development and the beginning of seed formation. When the seeds reach approximately ~3 mm (1/8 inch) in length, the plant enters the R5 stage, also known as the beginning of the seed-filling period. From this point, seed filling accelerates rapidly, while root growth begins to slow. As seeds develop, the plant shifts its energy and resources (photoassimilates) toward seed development, resulting in increased dry matter accumulation in the seeds.



Soybean plant with flowers
(R2 stage)

Gradually developing pods
(R3 stage no seed to R4 stage small seed)

Beginning of seed-filling in Pods
(R5 stage)

Watch out for stress and disease during seed filling

This stage is also sensitive to diseases. In warm and moist environments, the chance of disease infestation increases. For example, Soybean rust (causes defoliation during seed filling, leading to yield loss), Leaf spot (reduces the photosynthetic area, directly affecting seed development), Cercospora Leaf Blight (causes purple pigmentation on the upper leaf surface and the seed coat, reducing seed quality), etc. can increase during this stage. Similarly, white mold and sudden death syndrome (SDS) begin to show up at this stage, causing premature wilting and death of upper plant parts. Hence, this stage is an ideal time to assess the severity of these diseases.

What happens when seed grows beyond R5 stage to R6 stage?

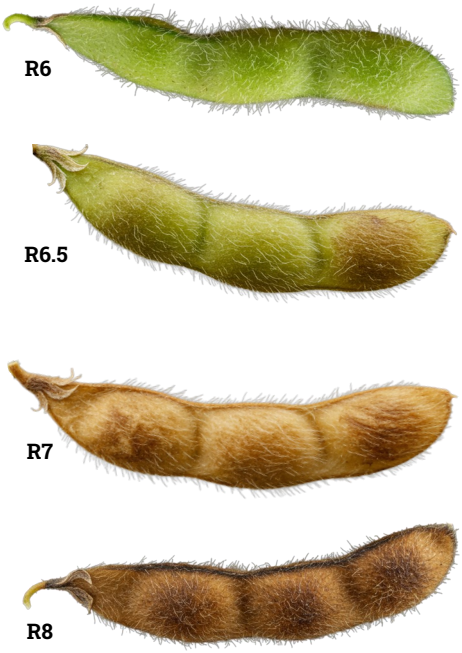
During the R5 to R6 stages, soybean plants undergo intense physiological activity to fill seeds, which then slows down as the seeds reach full maturity. This active seed filling phase lasts for about 2 to 3 weeks. Several important processes undergoes during this period. There is **rapid dry matter accumulation**; once seeds begin forming at R5, the plant's dry weight accumulation transfers largely to the seeds. In the weeks following R5 stage until around the 3rd or 4th week, nitrogen uptake by the roots and existing nitrogen in vegetative tissue begin rapid remobilization to the seeds.

Essentially, the plant shifts entirely from building structure to seed filling during the R5 to R6 stages. During this stage (R6), i.e., by around 3rd week after the R5 stage , the soybean plant reaches its maximum height, node number, and leaf area.

Canopy and Root growth: The canopy reaches its full size, maximizing light interception for photosynthesis. Vegetative growth slows to a stop on indeterminate varieties; the last new flowers and pods at the top of the plant appear by the R5 stage. Root growth also changes. Primary and lateral roots grow vigorously up to the R5 stage, but after the R5 stage, the shallow roots begin to senescence while deeper roots continue growing until roughly R6.5, i.e.,R5+3rd to 4th week. By about R6.5, root growth is completed.

What changes can be seen in soybean pods and seeds as they mature?

- Pods and seeds **gradually change color and moisture content**.
- At R6 (full seed), the pods are green, and the seeds moisture is ~70-75%.
- By R6.5, seeds have accumulated most of their dry weight, and moisture drops to ~60-65%.
- By R7 (beginning maturity), pods turn yellow-brown and seeds have <50% moisture (shows **physiological maturity**). At this stage, seeds have lost much of their moisture, and pods turn brown.
- After R7 stage to R8 stage, seeds continue to dry down (to~13% for harvest), seed dry weight reaches its maximum.
- At the R8 stage, marked by dry pods and mature color, indicates full maturity. At this point, no additional dry weight is added.
- After the R8 stage, with the pods and stems fully dry, **the plant is ready for harvest.**



Change in Pods from R6 to R8 stage

Pods beginning to mature (R6 to R7 stage)

Typical change in plants?

Toward the end of the R6 stage and into the R7 stage, **the plant begins to age**. Lower leaves start yellowing and even dropping before the R7 stage as nutrients are pulled out of them (it's not unusual to see a few bottom leaves fall prior to visible yellowing). By the R7 stage (one mature pod), leaf yellowing and leaf drop accelerate.

Mature Pods (Ready to Harvest) (R8 stage)

Indeed, this farmer's old adage provides wisdom on how to be careful in seed filling months, August and September, which coincide with the mid-seed filling phase, during which the final seed size is determined. As the plant reaches peak physiological and structural development, different practices that enhance the assimilate supply – maintaining green leaf area, avoiding defoliation, and supplementing nutrients – can extend seed filling, improve seed composition, and maximize soybean yield potential. Farmers can make timely, yield increasing decision by understanding these dynamics.

Remember, what you do in August and September shapes the soybean harvest in October/November.

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- Other Sources: 1. Iowa State University Extension and Outreach, 2. Farm Progress, 3. Cool Bean

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