Vegetative Soybean Growth and Development

**Emergence (VE)**

During germination and emergence, the cotyledons develop through the soil and primary and lateral root systems begin. Functions include root development and nutrient uptake. When the plant is at this early stage:

**Management Practices**

- Scout for proper emergence; check final stand and uniformity. Optimum seed placement varies from 1 to 2 inches deep. Deeper planting depth (greater than 2 inches) and lower soil temperatures jeopardize final emergence. If the stand is poor, replanting may be necessary.

**Cotyledon (VC)**

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

**First trifoliolate (V1)**

The plant becomes self-sustaining as newly developed leaves carry out photosynthesis. From this point onward, new nodes 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 trifoliolate leaves (fully developed leaves at the unifoliolate nodes). Check for effective radiation. Radiation must have been initiated on the roots at this stage and nitrogen fixation continues until late reproductive stages. Effective nodulation results in higher yields and more seed protein compared with a 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, will inhibit nitrogen fixation activity.

**Trifoliolate leaf unrolls (fully developed leaves at the unifoliolate nodes)**

The nitrogen fixation process can contribute a significant amount of nitrogen to the plant. Soybeans are a nodulating legume, establishing a symbiotic relationship with nitrogen-fixing bacteria such as Rhizobium sp. The nitrogen fixation process can contribute a large proportion of the total nitrogen needed by the plant.

**Trifoliolate leaf unrolls and primary and lateral root growth continues up and down the stem**

**Pod Formation and Maturation**

Pod formation can be divided into five stages:

1. **Beginning flowering (R1)** — The plant has one flower open at any node on the main stem. Indeterminate plants start flowering at the top of the main stem, and then flowering proceeds up and down the stem.

   **Management Practices**

   - Scout for insects and diseases. Spray foliar insecticide or fungicide, if needed.

2. **Beginning pod (R3)** — Pods are ¼ inch long on one of the four uppermost nodes on the main stem with a fully developed leaf.

   **Management Practices**

   - Scout for insects and diseases.

3. **Beginning seed (R5)** — Seeds are 1/8 inch long in one of the four uppermost nodes on the main stem. Most nutrients have been taken up by the time the plant reaches R5 stage.

   **Management Practices**

   - Scout for insects and diseases.
   - Late-season diseases can severely lower yields.

4. **Full seed (R6)** — Pods contain a green seed that fills the cavity in one of the four uppermost nodes on the main stem. Pods must be fully filled by harvest. The deeper roots and lateral roots grow strong during this stage.

   **Management Practices**

   - Scout for insects and diseases. Late-season diseases can severely affect yields. Spray foliar insecticide or fungicide, if needed. Late-season hail damage is when the plant reaches R6 stage.

5. **Full Maturity (R8)** — The seeds are mature and ready to harvest. At R8, seeds are attached to the pod and intact in the pod, and harvestable yield is reached.

   **Management Practices**

   - Scout for proper emergence; check final stand and uniformity. Optimum seed placement varies from 1 to 2 inches deep. Deeper planting depth (greater than 2 inches) and lower soil temperatures jeopardize final emergence. If the stand is poor, replanting may be necessary.

   - Scout for early-season weeds, insects, and diseases. Effective nodulation results in higher yields and more seed protein compared with a non-nodulated soybean plant.

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

**Seed-filling process**

**Example of changes in water content in the seed**

**Information and drawings about developmental stages are adapted from Fehr and Caviness (1980).**