

Burrus Buzz

Delivering more than just seed!

May 22, 2015



Soybean Germination/Emergence

by Matt Montgomery

Soybeans are being planted, have been planted, are coming up, and are putting on trifoliates. Burrus therefore thought it would be useful to review the soybean germination process from planting to the unifoliate leaf stage.

- 1) **Planting** – Soybean seed is deposited in the soil. While appearing to be inanimate, the soybean seed is a living organism – albeit in a dormant/suspended state.
- 2) **Water Imbibition** – The seed coating, termed the “testa” is permeable and begins to passively soak up moisture. Unfortunately, the dormant seed is not too selective when it comes to this movement of liquids into and out of the seed. Materials needed within the seed therefore exude from it (at least initially). The integrity of the testa (how cracked the seed coat is) proves incredibly important at this point. If the testa is too damaged, the soybean seed will continue to leak material, pathogens will use that exuded material to hone in on/injure the plant, and emergence will prove very unlikely. Lipids within the plant must reorganize during this time to make the seed selectively permeable. Cold water imbibed at this point may keep this reorganization from occurring. That means more leakage and a poor likelihood of emergence.
- 3) **Testa Splits** – Within 24 hours of the seed being planted, it has swollen to twice its previous size. Once water makes up 50 percent of the plant’s weight, cellular metabolism begins to radically increase. Cells begin to divide and multiply. Materials within the seed are used to fuel this biological activity, and that biological activity requires oxygen while also releasing carbon dioxide. The soybean seed has one easily observed characteristic – the hilum. The hilum is literally the “belly button” of the seed. It is the scar left over from the seed’s attachment to the pod. Near the hilum is a small hole termed the micropyle. The micropyle is literally the breathing pore for the seedling. Oxygen comes in through that hole and carbon dioxide leaks out. The testa begins to split (slightly) allowing the radicle to emerge. The radicle will eventually become the young root of the plant.
- 4) **Radicle Expansion** – Once emerged, the radicle (the young root) begins to develop quickly. The radicle is the “bottom end” of the young plant embryo (the immature plant nestled between either half of the seed/between each of the cotyledons). That young embryo contains nodes, the growing point, and the first true unifoliate leaves. The radicle serves three immediate important functions. First, it provides another avenue for water movement which further assists metabolic activity. Second, it provides another avenue for gas exchange which also assists metabolic activity. Third, it becomes a firm anchor for the plant. This anchor/this leverage will be needed when the hypocotyl (the region between the radicle and cotyledons) begins to expand.
- 5) **Hypocotyl Expansion** – The hypocotyl, the region between the young root and the two halves of the seed (cotyledons) enters a period of rapid cell division and growth. This begins to pull the cotyledons toward the soil surface. The cotyledons, the two halves of the seed, provide the building blocks needed for plant development. Whereas a grass seed is largely made up of starches, the soybean cotyledon is largely made up of proteins and lipids. The cotyledons also function as a protective structure. This protects the young embryonic plant nestled within. More importantly this protects the growing point (epicotyl) found near the top of that embryonic plant. Should the epicotyl be lost, the plant will be unable to grow new plant material and it will die.
- 6) **Emergence** – The hypocotyl continues to pull the cotyledons toward the soil surface forming a crook or arch until that tissue detects sunlight. At this point, the hypocotyl straightens and pulls the cotyledons above the soil surface. The testa (the seed coat) sloughs off as the cotyledons emerge. The two cotyledons now begin to separate from one another while also turning green. The green coloration is due to the formation/activation of chlorophyll. For the next week to ten days, the cotyledons will break down proteins and lipids to produce essential building blocks for plant growth while also producing the sugars needed to fuel/further build upon plant growth. The stage is typically referred to as VE. This represents another vulnerable stage for the plant. Should the upper portion of the plant be removed, the plant will effectively be dead because it will have lost its growing point.
- 7) **Unifoliate Emergence** – Unifoliate leaves, the first true leaves associated with the plant – not the fleshy cotyledons that have feed the plant up to now – pull from the cotyledons and unfurl. By this time, the mass of the cotyledons is now less than a third of what it once was. Termed VC, the plant will now rapidly produce trifoliate leaves and additional growing points. Within a short period of time, the plant will have become much less vulnerable.

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Planting Large Bean Seed

The topic of large bean seed occasionally becomes an issue. There can be a couple different reasons for this. In 2013, we encountered large bean seed that was a direct result of very late rainfall in 2012 seed production fields. Plants had already set the number of pods and number of seeds per plant. Late rainfall could only add yield to already existing beans, which caused them to swell. The result was large seed. Occasionally though, the genetic blueprint of a plant results in larger than normal seed. In other words, large seed is just a characteristic of certain varieties.

So what exactly does that mean for the grower? How can they determine if planter calibration is needed to seed at the right rate? The answer depends upon the type of planter being used and the number of seeds per pound (a measurement of seed size – think of less than 2500 seeds per pound being large seed).

Kinze “brush type” planters may require a move from the 60 cell black plate to the 48 cell blue plate. John Deere “radial bean metering” planters may also require a change in plates or switching from an “A,” “B,” or “C” setting. Vacuum style planters may require an adjustment of the vacuum setting or may require no change at all. The guide below is our planter calibration chart. It does not replace the operator’s manual for each planter, but it is a good quick reference/first step in the planter calibration process.

One other note on planter calibration. Burrus has produced a Burrus Agronomy U session on this very topic. Those interested in learning more can tune into that session at: <https://www.youtube.com/watch?v=zz2RA9yRxGU>.

Guide to Accurate Soybean Planting

	Small to Normal Seed Size 2500 seeds per pound or greater; 56 lbs. or less per 140k unit	Large Seed Size 2500 seeds per pound or less (1800 to 2600) 56lbs per 140k unit
John Deere Non-Vao (Brush Type) (Radial Bean Meter Type Planters) *1 *4 *5	Using Kinze Brush Meters - (2600 seeds/lb or More) Black Brush Type 60 Cell Seed Metering Plate Using Radial Metering Bean Plate - (3700 - 4600 seeds/lb) setting "A"; (2800 - 3700 seeds/lb) setting "B"	Using Kinze Brush Meters - (2600 seeds/lb or Less) Blue Brush Type 48 Cell Seed Metering Plate Using Radial Metering Bean Plate - (2000 - 2800 seeds/lb) setting "C"
Kinze Non-Vao (Brush Type Planters) *2 *1 *5	(2600 seeds/lb or More) Black Brush Type 60 Cell Seed Metering Plate	(2600 seeds/lb or Less) Blue Brush Type 48 Cell Seed Metering Plate
John Deere Vao Planters *3 *1 *5	Only one disk option - Vacuum setting at 8	Only one disk option - Vacuum setting at 9 (test and adjust accordingly) If feeding problems persist - remove the elbow from the hose feeding the hopper
Kinze Vao Planters *2 *1 *5	Use 80 oell plate - Singular setting of 6 - Vacuum setting at 10	Use 60 oell plate - Singular setting of 6 - Start vacuum setting at 10 (test and adjust accordingly)
Case IH Vao Planters *8 *1 *5	(2600 - 3600 seeds/lb) 183017A1 disc - Singulator setting at 8 - Vacuum at 15-17" (3600 - 4600 seeds/lb) 87420830 disc or comparable - Singulator setting at 8 - Vacuum at 15-17" (2600 - 3600 seeds/lb) 8788875 disc or comparable - Singulator setting at 8 - Vacuum at 15-17"	(2000 - 3600 seeds/lb) 8788875 disc or comparable - Singulator setting at 8 - Vacuum at 15-17"
White Vao Planters *7 *1 *5	(3000 - 4600 seeds/lb) Use 7000722513 (120 oell) disc - Air pressure at 1 - 3" (2000 - 3600 seeds/lb) Use 862432 (120 oell) disc for 30" rows - Air pressure at 2 - 2.6" (2000 - 3600 seeds/lb) Use 862438 (80 oell) disc for 16" rows - Air pressure at 2 - 2.6"	(2000 - 3600 seeds/lb) Use 862432 (120 oell) disc for 30" rows - Air pressure at 2 - 2.6" (2000-3600 seeds/lb) Use 862438 (80 oell) disc for 16" rows - Air pressure at 2 - 2.6" (test and adjust accordingly)

*1 Consult the operator's manual for additional talc/graphite recommendations

Always check the operator's manual

*2 One TBSP of graphite per hopper for a standard 2 bu hopper, and 1-1.5 lbs of graphite per 60 unit container

*3 For central fill planters use a 1/2 rate of talc for untreated beans and a full rate (nom rate) of talc with treated beans

*4 Add 3/8 TBSP of graphite per hopper

*5 Adjust speed as directed in the operator's manual

*8 Consult the operator's manual for seed disc RPM recommendations

*7 Do not exceed 86 RPM on seed disc