CROPFOCUS

Best Management Practices for Optimum Soybean Nodulation on Virgin Ground

Soybean nodulation

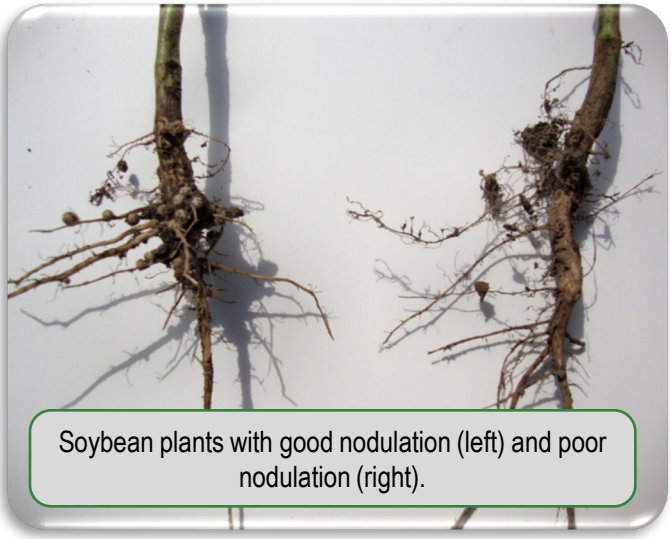
- Soybean roots form nodules when rhizobia bacteria in the soil invade and colonize the growing root tissue.
- It is a symbiotic, or mutual, relationship where the plant supplies energy to the bacteria in exchange for the bacteria "fixing" nitrogen from the air into a usable form for the plant.

Why is nodulation essential?

- Soybeans are a high protein crop (approximately 40% of the plants makeup) and require about 3.5 lb of nitrogen per bushel of grain produced.
- Nitrogen serves as the foremost building block of protein structures, therefore maximizing nodule formation and nitrogen fixation is vital.

Soybean production on virgin ground

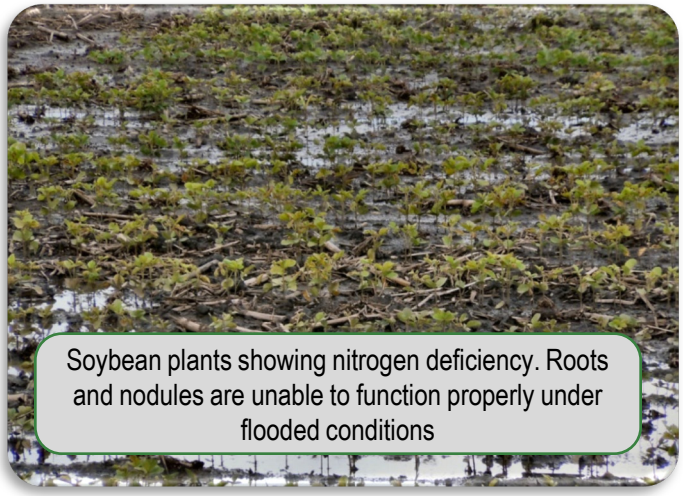
- Virgin ground refers to farm ground where soybeans have never been planted before or have not been grown for several years.
- Soybeans and rhizobia bacteria are not native to North America, therefore rhizobia bacteria must be introduced into the soil and maintained at sufficient levels to provide adequate nodulation.
- In fields where soybeans have not been grown for several years (ground coming out of CRP, continuous corn or wheat, etc.) rhizobium bacterial levels may be extremely low which can adversely affect soybean nodulation.



Soybean plants with good nodulation (left) and poor nodulation (right).

What might cause reduced nodulation in a soybean crop?

- Low rhizobia bacterial levels in the soil
- Lack of oxygen due to soil compaction or over-saturated soils
- Rhizobia source applied to the seed was not viable at planting time
- Drought stress
- High available nitrogen in the soil; nodules will not form if the soybean plant has an elevated amount of nitrogen available to it.



Soybean plants showing nitrogen deficiency. Roots and nodules are unable to function properly under flooded conditions

Rhizobium inoculants

- Rhizobium inoculant products not only provide a source of rhizobia but many also supply supplemental biological agents which can be beneficial to crop growth and development.
- An inoculant should always be applied when planting soybeans into virgin ground.
- It is important to follow all label directions and storage and handling guidelines for the inoculant product used.

Best management practices

- **Always apply inoculants to soybean seed:**
  - When soil pH is below 5.8 or above 8.5
  - If soil organic matter is less than 1%
  - If soil conditions are above 80 F at planting
- **Application timings**
  - Apply an inoculant as close to planting as possible
  - A secondary application of a granular inoculant in the planter box has been shown to increase nodulation and yield in some cases.
- **Inoculant care and handling**
  - Store product under 77 degrees, and do not allow to freeze
  - Store out of direct sunlight and heat

Assessing nodulation

- Check first year soybeans around the V2 stage (two complete trifoliates) for presence of nodules. 7-14 nodules per plant is adequate at this stage.
- If less than 5 nodules per plant are present, wait a week and take another assessment.
- Nodules will to continue to fix nitrogen and increase in number up to R5.
- Healthy nodules appear pink or red when split open.
- Green, brown, or white nodules indicate little to no fixation is occurring.
- If number and quality of nodules is not sufficient, supplemental nitrogen should be applied.

Soybean field showing nitrogen deficiency symptoms due to poor nodulation.

Supplemental nitrogen application

- Apply at a rate no greater than 44 lb/A of actual N; higher rates of applied N are usually not profitable.
- It is best to apply urea treated with a urease inhibitor.
- A liquid form of N such as 28% UAN can cause significant leaf burn to the crop canopy, so special attention must be paid to the area of application when using a liquid form of N.
- Apply at early flowering when foliage is dry; band between rows if possible.