Stimuplant: Soybean Inoculant

Reg. No. L5799 Act 36 of 1947 (Powder) and
Reg. No L9012 Act36 of 1947 (Liquid)

Use *Bradyrhizobium japonicum* strain WB74 bacteria for effective nitrogen fixation in soybean (*Glycine max*)

Why must soybeans be inoculated?

In nature root nodulation is difficult, since bacteria responsible for effective nodulation are scarce and sometimes not even present in the soil.

However, when seed is treated with the correct rhizobium bacteria, plants that develop are immediately in contact with large numbers of the desired bacteria. The plant can then develop more nodules and more effective root nodules that lead to better nitrogen fixation.

Only use the correct and specific rhizobium for the right legume crop.

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What is an inoculant?

An inoculant consists of specific Rhizobium bacteria in a carrier in which the bacteria live. It is used to inoculate seed so that nitrogen fixation can happen.

What is Rhizobium?

Rhizobium is specialized soil bacteria. Due to their unique biological characteristic that enables them to bind nitrogen from the atmosphere there are many established mutually beneficial interactions with the roots of legumes. This symbiosis leads to the formation of specialized structures on legume roots, known as nodules.

Inside these root nodules rhizobia absorbs carbohydrates from the plant and in return it binds nitrogen from the atmosphere for use by the plant. Legumes are unable to bind nitrogen from the atmosphere by itself, although it is able to absorb nitrogen from minerals in the soil. Rhizobium only binds nitrogen if it is present inside the root nodules.

Rhizobia are microscopic single-celled organisms. They are small organisms and can only been seen under a microscope. Thousands of cells of rhizobia fit onto a needle tip. (See Figure 1) Registered commercial inoculant contains single strains of specific rhizobia that provide optimal nitrogen fixation within the specific legume crop.

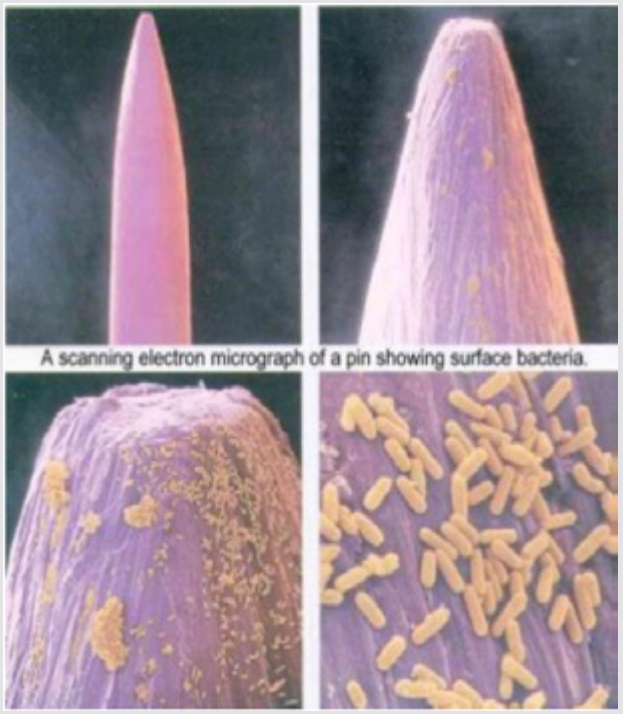

Fig 1: *Rhizobium* on the tip of a needle

Why is Rhizobium so specific?

The relationship between certain rhizobia and a specific legume is very specific. Different legumes are inoculated by clearly different rhizobia. Specific rhizobium will only nodulate and fix nitrogen with a specific legume. Ex, lupines are inoculated by slow growing acid-tolerant rhizobium bacteria species while medics are inoculated by the rapidly growing, acid-sensitive Sinorhizobium species.

In different soils inoculant bacteria must compete with indigenous soil organisms or other strains of bacteria, so either the one outcompetes the other or after a period of time (some years) both will be in balance. This is one of the main reasons why soybeans need to be inoculated each year or season.

When should I inoculate?

When planting any legumes, inoculation should be considered because of the potential nitrogen fixation and potential increase in yield.

Important points to keep in mind when inoculation is considered:

- The legume has not previously been planted in the specific land/field
- To increase the natural numbers of the rhizobia already present in the soil.
- The land is acidic or very alkaline, which may affect the rhizobia numbers in the soil adversely
- The land is exposed to high temperatures or dry summers which will decrease the rhizobia numbers from the previous season.
- The legume is rhizobia specific so if it is a different legume a different rhizobia is needed.

Some publications suggest that inoculation is not necessary if the legume host has been planted and inoculated in the previous four years on the specific land. The problem with this rule is that it does not take into account the level of the nodulation of the previous crop, and that the current population of rhizobia in the soil may be affected.

There are two factors which give rise to this:

1. Most soils are not beneficial to the survival of large numbers of rhizobia over a long period due to factors such as extremes in pH, low clay content, high temperatures and dry periods.
2. Colonies of rhizobia developed during the cultivation of legumes year after year is often less efficient binding nitrogen with the passage of time, so every time preferably inoculate plants when it is planted.

What is the right Bacteria?

It is a specifically selected rhizobia bacterium specific to each crop with the following characteristics:

- **Competitiveness:** Most soil contains rhizobium, and many of them outcompete other rhizobia during infection. Therefore, a strong competitive strain is essential.
- **Infectious:** The rhizobium effectively penetrates the root hair and forms a nodule.
- **Effectiveness:** The Rhizobium effectively fixes nitrogen in the nodule. An effective nodule is large and pink inside. Ineffective nodules are small and white.

An effective strain meets all the above requirements

How should I handle inoculants?

- Always follow the manufacturer's label / instructions
- Store inoculants in a cool, dry place (not necessary for refrigerator and keep below 25 °C)
- Do not leave the inoculant in direct sunlight
- **Do not use inoculants past the expiry date**

There are two different ways of applying inoculants:

1. The inoculant is mixed with water and an adhesive, then applied as a slurry directly on to the seed.
- The seed and slurry must be mixed well.
- Keep the seed out of direct sunlight after treatment, because ultraviolet rays kill bacteria (A short exposure is not harmful).
- Plant as soon as possible after treatment, because dehydration also kills the bacteria.
- Seed needs to be planted on the day of inoculation (within24 hours), unless the labels states otherwise.

2. It can be applied as liquid.
- Suspend the inoculant in water
- The liquid (which contains the bacteria) can be applied in-furrow with a special applicator on the planter.

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