Inoculant Guide

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Sponsored by VAULT® Peanut Inoculants from Becker Underwood
with exclusive BioStacked® Technology

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Yield Is The Incentive

Valuable yields are waiting in each peanut seed. The yield potential of each seed is at its maximum when it is put into the ground. Decisions such as crop rotation and field selection help the seed reach its full potential. Irrigation and pest management help protect that yield potential. However, stresses, such as disease pressure, drought and not being timely with inputs, lowers the bar on what yields can be achieved.

Peanut profitability is reached through high yields or by cutting production costs. Unfortunately at times, reducing inputs to cut production costs can negatively impact yields, thereby reducing the profit margin. A better plan is to focus on giving the crop every possible opportunity to achieve that maximum yield potential.

A Good Start

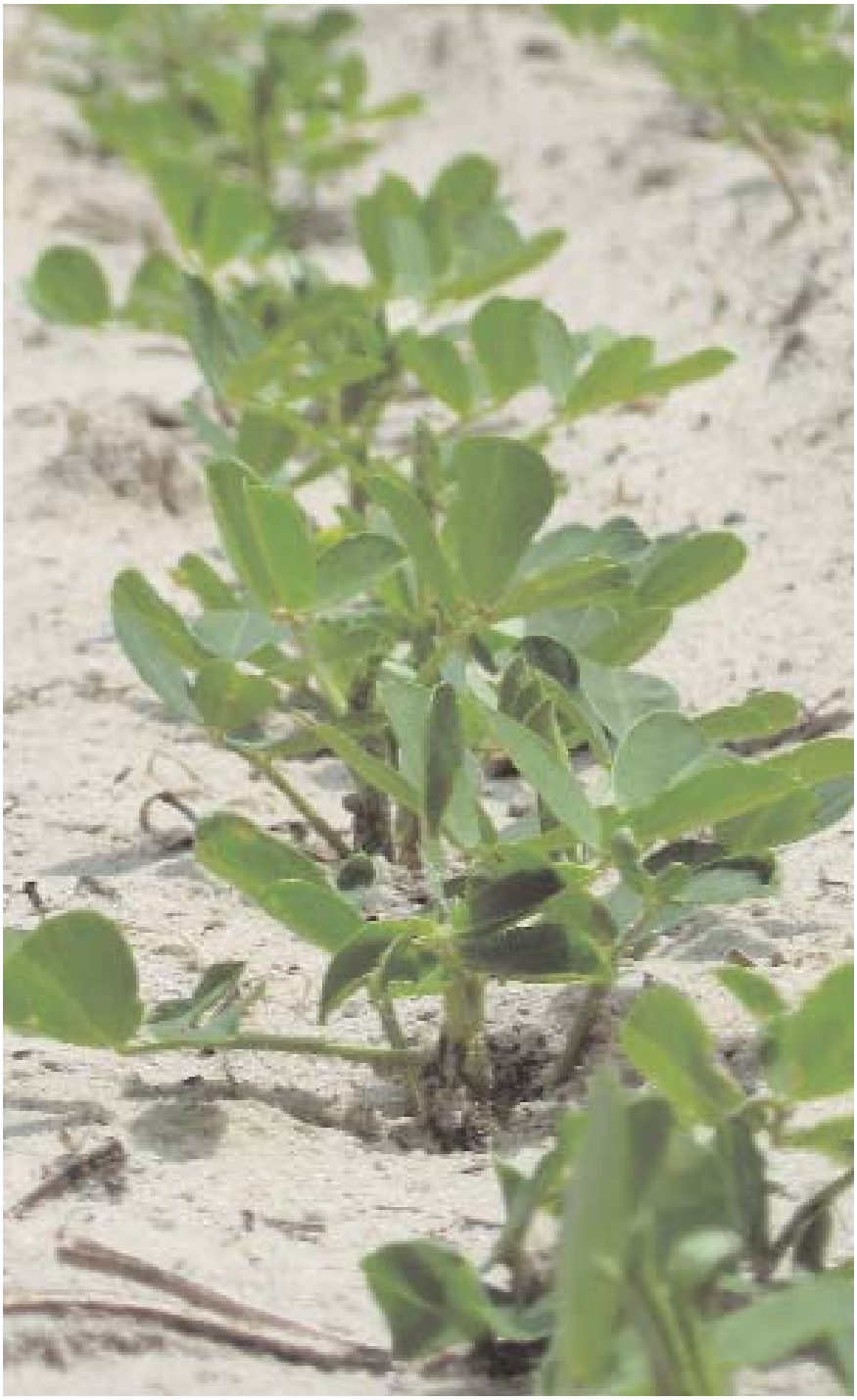
One critical component to peanut growth is the inoculation process. Researchers agree that peanuts respond better to the nitrogen fixation provided by *Rhizobia* bacteria than it does to direct application of nitrogen fertilizer.

The question is, "Should you trust that viable, peanut-specific *Rhizobia* is in the soil in sufficient amount to properly nodulate the crop or should you make sure it is there?"

Placing a fresh, high quality inoculant in a concentrated area around the seed where it can enter into the root quickly will give that emerging peanut plant the best start. At the earliest opportunity, the beneficial bacteria can enter into the roots and begin multiplying, making nitrogen quickly available to the plant. From here, vigorous growth is achieved, and canopy closure is attained more rapidly.

A lack of viable, peanut-specific *Rhizobia* in the soil and in close proximity to the seed means that time is lost while the seedling waits for bacteria to arrive. The lack of nitrogen slows the growth process and allows for problems, such as disease, to attack the sluggish seedling.

The importance of good *Rhizobia* inoculation should not be overlooked. When good nodulation is achieved, the maximum yield potential is still achievable. A lack of proper inoculation results in the need for supplemental nitrogen, but yields will already be affected by the reduced amount of this essential el-



A Small Investment That Pays Big

Applying an inoculant each time peanut is planted is a good way to make sure fresh, live, peanut-specific *Rhizobia* bacteria are present in the soil and ready to begin making nitrogen available to the seedling.

Although the cost of an inoculant is one percent or less of a total peanut budget, some producers still go by recommendations based on the number of years between peanut plantings.

David Jordan, North Carolina State University peanut agronomist, conducted a series of trials comparing varieties, fumigation treatment with metam sodium and inoculant in rotations with various sequences of peanut, cotton, corn and tobacco. In these experiments, rotations ranged from as many as five years out of peanut to continuous peanut.

Jordan was surprised to find that peanut responded to an inoculant in some situations he did not expect. Conversely, in some situations where he expected a response, none was found.

"These experiments indicate that predicting whether or not peanut will respond based on the number of years between peanut plantings is not the most appropriate technique," Jordan says.

This research, and that of other researchers, shows the difficulty of determining when peanut will respond to an inoculant and that many factors can influence efficacy of inoculants in addition to the length of crop rotation.

Consider The Yield And Cost

In another study, Jordan looked at yield response to nitrogen rate and source when applied in early July at the first sign of nitrogen deficiency.

In these studies, he found that the peanut yield was significantly different than when no inoculant or nitrogen source was applied. Also, none of the nitrogen source treatments were greater than the yield achieved in Duplin County in 2008 using an inoculant.

In 2007, some of the yields achieved with ammonium sulfate were similar to the yield with inoculant usage, with one rate being slightly higher. In Rocky Mount, some of the treatments were similar in yield.

Although similar yields were achieved in a few situations, the costs of applying an ammonia fertilizer directly takes away from the profit margin that is gained from using an inoculant alone.

Peanut Yield Response To Nitrogen Rate And Source

Nitrogen Source	Actual N Rate (lb/A)	Pod Yield (lb/A) Duplin County 2007	Duplin County 2008	Rocky Mount 2008
-	-	2,196	3,530	3,247
Inoculant	-	3,470	6,256	3,889
Ammonium sulfate	60	3,333	4,866	3,698
Ammonium sulfate	90	3,072	5,125	4,070
Ammonium sulfate	120	3,624	5,494	3,986
Ammonium sulfate	150	3,181	5,898	3,832
Ammonium nitrate	60	3,290	4,455	3,719
Ammonium nitrate	90	2,767	4,992	3,554
Ammonium nitrate	120	3,247	4,801	3,224
Ammonium nitrate	150	2,972	5,188	3,301

** Nitrogen was applied in early July when nitrogen deficiency symptoms were first noted. Fields were not planted in peanuts during the previous years.*

Investment Or Insurance?

Ultimately, you may decide it's both an investment and insurance. An inoculant is an important input for making a crop with the highest yields possible. Or, it could be more like an insurance policy in that you are giving your crop every opportunity to grow well. Whatever your reasoning, once you have the inoculant, take every precaution to keep it viable until it is safely in the furrow with the peanut seed.

An inoculant should be bought fresh each year for maximum viability. Inoculants should be kept completely away from direct sunlight and are best stored at temperatures from 40 to 77 degrees Fahrenheit. Do not freeze the product. Once a package has been opened, use it within 24 hours.

Maximize Your Return On Investment

At application, make sure the inoculant is placed in direct contact with the seed for maximum uptake. If planting conditions are less than ideal, consider using a little more than the recommended rate. If water is used as a carrier for the inoculant, chlorine-free water, such as well or rain water, should be used. Refer to the product label for further care and handling instructions and for application rates.

Other conditions that may affect the *Rhizobia* are as follows:

- Acidity: *Rhizobia* and/or their effectiveness may be reduced in soils with a pH below 5.5 or above 8.0.
- Organic matter: The live bacteria survive better in soils with increased organic matter content.
- Temperature: *Rhizobia* populations can be reduced in hot, dry soils, particularly at planting, and may not survive if seed are planted too shallow. Cool soil temperatures may slow bacteria movement into the roots.
- Drought: Moisture is needed for *Rhizobia* to survive. Prolonged drought or *Rhizobia* applied into a dry seedbed can reduce bacteria levels or activity.
- Flooding: Depletion of oxygen in the root zone can kill *Rhizobia*.
- Competition: Other strains of bacteria and soil organisms competing for moisture and nutrients may reduce the amount of *Rhizobia* or its effectiveness.
- Plant stress: Any practice or conditions that put stress on the plant can reduce the nutrients available to the *Rhizobia* bacteria thereby reducing formation of nodules.
- Nitrogen level: Formation of nodules can be reduced if nitrogen fertilizer is applied to the soil, even levels as low as 30 pounds per acre.
- Tankmixes: Seed treatments or pesticides may be toxic to the bacteria. Read product label for compatibility.
- Soil conditions: Compaction and erosion may reduce *Rhizobia* populations.

Inoculants used today offer more than those applied in the past. As it's been said before, *Rhizobia* are live organisms. Only the best and most vigorous *Rhizobia* strains are used to create the next inoculants. As technology and selection of *Rhizobia* strains improve, it may be beneficial to replace or to renew native strains with more efficient strains of *Rhizobia*.

More Than An Inoculant

Some inoculant products offer more than just the inoculant itself. Added biological agents may work to improve vigor and reduce seedling disease, giving your crop an added boost.

Consider putting an inoculant to the test. Mark an area of a field or two and make comparisons of different product types, planting depths or other practices that can be manipulated. Keep a record of growth stages and your general observations of how well the crop is doing.

At the proper time, perform a nodule count, and check to see that nodules are bright red and actively fixing nitrogen. Record disease pressure and other pest issues. Finally, keep track of the yields for each plot. Putting inoculants to the test may be the best way for you to determine what works best in your operation.

A Rapidly Progessing Science

These Are Not Your Father's Inoculants

Like the seeds that your father and grandfather planted are vastly different than what you and your sons plant today, so, too, inoculants are not the same.

Researchers have learned how to move desirable traits in and out of seed, to stack desirable traits and to select for the most vigorous and productive markers. In the same way, researchers have learned more about the bacteria that is applied in the inoculant product.

The science and technology of bio-inputs are leading to products that do more than inoculate the crop to produce a greater return.

Recently, Becker Underwood was granted exclusive rights to patented nitrogen-fixing technology developed by a team of researchers at McGill University, Montreal, Quebec. The licensing agreement will allow Becker Underwood to lead the development and commercialization of this new technology and to introduce new and modern inoculant products.

Advances Mean More Yield

The technology involves a fatty acid compound shown to be highly effective in stimulating *Rhizobia* to produce the substances needed for increased nodule formation and greater nitrogen fixation.

Micro-organisms, such as *Rhizobia* bacteria, have evolved over time to live in association with plants and improve the ability of plants to grow. However, there is still much to be learned about these relationships and how to improve the synergy created by the two entities.

To capture the benefits of the newer inoculant technology, it is best to replace older, native strains of *Rhizobia* in the soil with newer, fresher, more advanced inoculant products.

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What To Watch For

Time and again, even the seasoned peanut producer can make a mistake that is detrimental to the inoculation process.

Whether it's allowing the product to deteriorate before planting or an equipment failure during planting, knowing those potential problem areas could help you to avoid those pitfalls.

Some common mistakes to avoid are as follows:

- Exposing the inoculant product, which are live bacteria, to higher temperatures and direct sunlight. Do not store inoculants in a barn or building that may get hot in the afternoon, and certainly do not place the product in the cab or on the dashboard of a pickup truck once in the field.

- Using chlorinated water to apply a liquid inoculant.

- Placing the inoculant away from the seed. Ensure that drop hoses and nozzles put the seed and inoculum together. Also, make sure sand does not close in over the inoculant, creating space between it and the seed.

- Forgetting to calibrate application equipment to ensure proper placement of the seed and inoculant.

- Using too low a rate of inoculant or using old, expired inoculant. Buy new, fresh inoculant each season and always read and follow product label directions.

- Planting too shallow. In some areas, planting too shallow can lead to the death of the *Rhizobia* before it has the opportunity to enter the plant.

- Tankmixing the inoculant product with an incompatible product that reduces the *Rhizobia* potency.

- Having a large amount of nitrogen fertilizer already available to the seed will curtail nodulation.

Always Check It Out

Poorly inoculated fields usually do not show any yellowing until about 45 days after planting. Even then, producers may think the yellowing is from causes other than poor nodulation. Therefore, it is always best to check the growing plants for active nitrogen fixation.

The scouting process is simple and straightforward. About five to six weeks after planting, carefully dig plants from several locations in the field. Be sure to use a shovel, as nodules caused by *Rhizobia* will easily slough off if the plant is pulled from the ground.

Examine the number of nodules on the roots. Fewer nodules may indicate a problem. However, even a great number of nodules does not mean that they are actively fixing nitrogen. To determine this, carefully slice open several nodules. Active nodules are pink to dark red inside. A white color inside indicates that the nodule is not yet active. Other colors may indicate that little nitrogen is being fixed.

If few nodules are found or the nodule color does not show active nitrogen fixation, wait approximately 10 days and check the field again. For various reasons, the bacteria may have been slow to enter the roots and multiply.

Upon the second inspection, if nodulation again appears poor, a nitrogen fertilizer will need to be applied to the crop. Remember, a lack of nitrogen will result in lighter colored or stunted plants, but these symptoms are also caused by many other problems.

Whether or not you applied an inoculant at planting, always scout for nodulation anyway. It is the most efficient way to be assured nitrogen fixation is occurring. If poor nodulation is found, you will need to apply a nitrogen fertilizer to the crop, and you will know to use an inoculant when next planting a peanut crop to that field. If an inoculant was used, but poor nodulation was found, then you will need to consider what went wrong and avoid making the same mistake twice.

Applying an inoculant and then scouting to make sure the nodulation process is occurring provides assurance that you have given your peanuts an opportunity to achieve maximum yields and quality.