

AGR-90

INOCULATION OF FORAGE LEGUMES

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REVISED:

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Inoculation Process for Forage Legumes

Legumes such as alfalfa, red clover, white clover, bigflower vetch, ladino clover or bird's-foot trefoil should be grown with grasses on most Kentucky pasture and hay fields. Legumes are generally higher in quality than the grasses. Also, properly nodulated legumes "fix" nitrogen (N); that is, they take N gas from the air and change it chemically so it can be used by legume plants to make protein and other components which contain N. Some of this fixed N becomes available to grasses growing with legumes.

Nodules are formed on the roots of legume plants when bacteria called Rhizobia "infect" root hairs. The bacteria obtain the energy for N fixation from the legume and in turn they supply the N needed for legume growth. Many nodule-producing bacteria may be present in soils; however, all are not equally effective in fixing N. To ensure that nodules will be formed from the best bacteria, you should properly inoculate legume seed before planting. This may be critical to the success of forage legumes, especially in fields which have not been recently seeded with the legume being used. Most commercial inoculants are sold as a mixture of Rhizobia and finely ground peat.

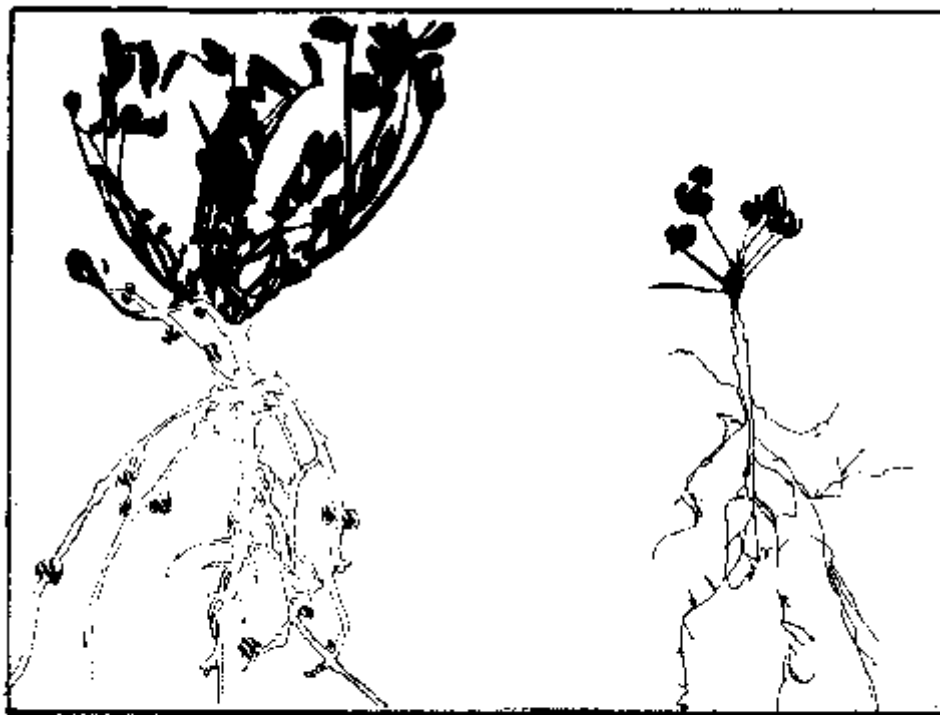


Figure 1.—Alfalfa seedlings showing large effective nodules from proper inoculation (left) and no nodules (uninoculated) (right).

For infection and N fixation to occur, inoculant bacteria must be: (1) correct for the legume on which they are used; (2) in contact with roots of the legumes they are to nodulate; and (3) alive and capable of infection ([Figure 1](#)).

Use Correct
Inoculant
Legume inoculants are divided into groups based on their capability of infection and N fixation. Alfalfa inoculant (group A) is used on both alfalfa

and sweet-clover. The clover group (B) is effective on alsike, red, white and crimson clovers (group R is more effective on crimson, but probably isn't available in stores). Cowpea inoculant (group EL) can be used on cowpeas and common, Korean and sericea lespedezas. The true vetches such as hairy and bigflower require inoculants in the pea-vetch group (C). Other legumes such as bird's-foot trefoil, crown vetch (which isn't a true vetch) and arrowleaf clover require inoculant strains which are specific for the species on which they are used.

Some inoculant manufacturers follow the practice of mixing the alfalfa and clover groups so that one inoculant may be used on most legumes seeded in Kentucky.

Check the inoculant package. If the legume species isn't listed on the package, don't use it!

Put Bacteria in Contact with Roots

The first thing which emerges from a germinating seed is the primary or first root. In legumes, this becomes the taproot. To be certain that large numbers of bacteria contact the roots, inoculant should be "stuck" to every seed. There is little assurance of this happening if dry inoculant is applied to dry seed. Wetting seed with water may help, but it is much better to wet with something sticky. Commercial sticking agents are best, but you can make your own by diluting one part of syrup or molasses with 9 parts of water.

It also helps to use large numbers of bacteria. North Carolina research has shown that using heavy inoculant rates and better stickers results in more nodules per plant and a greater percentage of plants nodulated than does using dry inoculant.

Be Sure Inoculant Bacteria Are Alive

Tests for live bacteria can be done in a laboratory. You don't have that capability, but there are some things you can look at to help you decide if the bacteria are likely to be alive.

(1) Date on the package

Each package of inoculant is marked with an expiration date. After that date, many bacteria are likely to be dead, therefore do not use outdated inoculant.

(2) How inoculants are stored

Even if the expiration date has not passed, many bacteria may be dead if they have been stored where the temperature is high. Leaving the package on the dashboard or even in your pick-up truck or car for even a short time may kill many bacteria. Best storage is in a refrigerator. Do not expose inoculant or inoculated seeds to sunlight. Ultraviolet light will kill bacteria.

(3) Condition of the package seal

Holes in the inoculant package may permit the peat and bacteria to dry and result in death of some bacteria.

Pre-Inoculated Seeds

Pre-inoculated and/or lime-coated seeds are on the market in Kentucky. Pre-inoculation is the process of sticking large amounts of inoculant to the seed at the processing plant prior to bagging. Often the pre-inoculated seeds are coated with finely ground limestone. This process offers seeds which are ready to plant. However, under most storage conditions, many of the nodule bacteria will not live for more than 1 to 3 months. This is especially true for seeds stored through the summer for fall plantings. Pre-inoculated seed carried over summer should always be reinoculated. Always reinoculate if there is any doubt. Since water or sticking solutions will cause the lime coating to "gum-up", use mineral oil (0.5

to 1.0 oz/lb of seed) to stick new inoculant to the seeds just prior to planting.

Inoculation Recipe*

- Place 25 lbs of seed in a tub.
- Use a commercial sticking agent or make one by diluting syrup or molasses with water, using 9 parts of water to one part of syrup. Shake well.
- Add only enough of the "sticker" solution to moisten the 25 lbs of seed and mix thoroughly, coating every seed with sticker. Don't add too much liquid! If you do, seed will stick together and will not flow through the seeder.
- Add 6-7 ounces of dry inoculant. mix to coat and dry the seeds. This is four times the rate recommended by most manufacturers, but is usually necessary for good nodulation in Kentucky, especially for alfalfa, bird's-foot trefoil or crown vetch. Seeds should be covered with inoculant.
- Air dry the seeds if necessary by spreading them in the shade. To speed the drying process, add more peat-based inoculant or a small amount of finely ground limestone.
- Plant seed as soon as possible after inoculation. If they can't be planted immediately, store in a cool place. Repeat inoculation if seeds are not planted within 24 hours. Do not leave inoculated seed in direct sunlight. Slightly moist soil provides the best conditions for bacteria.

*Adapted from North Carolina State University Publication AG-226.