

Making Lime-Pelleted Seeds

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Legumes have the ability to absorb, or "fix," atmospheric nitrogen, a necessary plant nutrient. This is done in the nodules of legume roots by *Rhizobia* bacteria. The proper bacterial species already may be present in the soil, but large numbers of the correct strain of bacteria on the seed ensure effective nodulation. Seeds are treated (inoculated) before sowing, and *Rhizobia* must remain viable in sufficient numbers near the seed to invade root hairs after seed germination.

Reasons for loss of bacteria viability

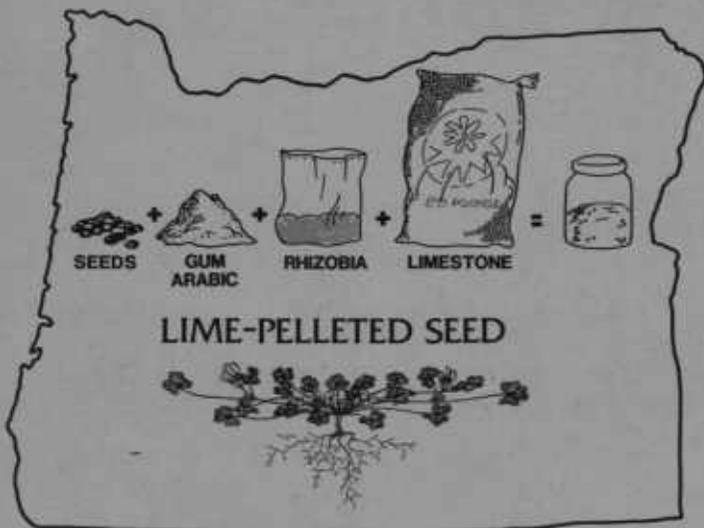
Loss of viability of applied bacteria on or in the vicinity of the seed results in ineffective nodulation and failure of the clover to establish. Seedlings become nitrogen deficient, resulting in yellow or reddish yellow leaves and eventual death of the seedlings. Poor survival of *Rhizobia* may result from various conditions:

1. Western Oregon soils are typically acid with pH values often below 5.5, particularly in areas being sown to non-irrigated pasture. Although most clover species are tolerant to acid soil conditions, *Rhizobia* may be affected adversely and greatly reduced in numbers or eliminated.
2. Bacteria are killed by radiation from sunlight when sown on the soil surface whether sown by air or with a ground implement.
3. Desiccation causes loss of *Rhizobia*. This can occur when drilling into dry soil or by surface sowing in dry weather.
4. When inoculated seeds are drilled in direct contact with superphosphate or other acid fertilizers, *Rhizobia* may be lost quickly.

These problems have been reduced by application of a protective coating around the seed and inoculum. Several materials have been investigated as protective coatings on the seed. Lime is preferred, since it is especially useful with acid situations.

Each lime pellet contains a legume seed, peat inoculant, gum or adhesive, and the surrounding lime coating.

Pelleting legume seeds with lime and the appropriate *Rhizobia* will assure successful nitrogen fixation under proper planting, soil, and growth conditions. The protective coating is especially effective on acid soils. Agricultural producers may want to prepare their own lime-pelleted seeds to assure *Rhizobia* viability. This publication describes the principles and techniques for pelleting seed.



Pelleting other species

Alfalfa and its appropriate *Rhizobia* are not tolerant to acid soil conditions. Therefore, liming the soil to the recommended pH is necessary. Pelleting is of benefit, however, in assuring adequate numbers of viable *Rhizobia* in contact with the seed.

Clovers are more tolerant than alfalfa to pH values below 6.0. Lime pelleting is of most benefit to the true clovers, especially when introducing a new clover or sowing in soil that has not grown the species before. This has application in western Oregon to subterranean, crimson, and arrowleaf clovers, which require special strains of *Rhizobia* prepared for the species. White, red, and alsike clovers seldom show ineffective nodulation in Oregon. These clovers, especially white clover, have been grown for many years and the *Rhizobia* are generally present in soils. Nevertheless, inoculation is always recommended to insure nodulation, and to provide large numbers of an effective nitrogen fixing strain to overcome less effective or parasitic strains already present.

Materials needed for pelleting

- *Gum or adhesive.* It must be water soluble and not detrimental to *Rhizobia* or seed. Gum arabic has been found to be satisfactory. It normally contains no preservative, is inexpensive, and is readily available through chemical supply outlets.

- *Lime.* Most of the limestone sources in Oregon have been investigated for compatibility with *Rhizobia* survival. Of these, Oswego lime and sugar lime provided excellent survival of the *Rhizobia*. The lime should be finely ground, mostly passing through a 200-mesh screen. Byproduct industry limes such as paper mills, acetylene, and stack dusts should not be used.

- *Peat inoculant.* The inoculant must be specifically labeled for the legume species and within the expiration date printed on the container.

Pelleting large lots of seed

1. Prepare a 40 percent solution of arabic gum by adding 4 pounds of the powdered gum to 1 gallon of water. This is enough for at least 100 pounds of seed. Slowly add the gum while stirring or shaking. The gum goes into solution very slowly and should be prepared the day before. Warm or hot water is helpful, but the solution should not be boiled. Make sure the water has cooled before adding inoculum, since hot water will kill the *Rhizobia*.

2. Next day, add peat inoculum to the solution and stir until there is a smooth slurry. Use at least the recommended amount of inoculum for the 100 pounds of seed (2 bushel size).

3. Put the seed into a concrete mixer or large container, add the gum-inoculum slurry to the seed while agitating until all the seeds are coated. If a mixer is not available, be sure to use a small enough quantity of seed for thorough mixing.

4. Add the lime and continue mixing, preferably at higher speed and with the vanes removed. About 50 pounds of lime is required for 100 pounds of sub- or crimson clover seed and slightly more for arrowleaf clover.

5. Lumps of seed may occur because of too much slurry or insufficient action in agitation. Any lumps should be broken up or removed before putting seed into the drill. Excess lime should be screened out before drilling unless "Easy-Flow" type openers are used.

Pelleting small amounts of seed

Small quantities of seed can be pelleted by using pint or quart jars one-fourth full of gum powder, then filled with warm water and shaken on occasion until the gum is dissolved.

Put the seeds in a tub or any suitable container, mix the required amount of inoculum with the gum solution to form the slurry. Pour on the slurry while stirring the seeds by hand, until all seeds are wet. Add lime with one hand while stirring vigorously with the other hand until the seeds are pelleted.

Planting can start immediately, especially if pellets are mixed with grass seeds, but they will harden and are easier to plant if allowed to stand a few hours. Plant at least within 48 hours.

- *Do not* use quicklime, industrial byproduct lime products, or calcium hydroxide as they may be toxic to *Rhizobia*.

- *Do not* make up gum solution more than about 36 hours before intended use. With no preservative, the solution is decomposed by bacteria and fungi and may become toxic to *Rhizobia*.

- *Do not* leave inoculated seeds or pelleted seeds in direct sunlight.

- *Do* plant pelleted seeds as soon as dry or within 48 hours, and refrigerate seeds if not planting immediately.

- *Do* use at least the recommended amount of inoculum—one packet per bushel of seed (60 pounds). Using two to three times this amount is good insurance of maintaining an adequate number of bacteria.

- *Do* throw away any gum solution and inoculum that are left over.

- *Do* wash containers before they become dry. If a cement mixer is used, add gravel to the water for cleaning.

Commercial pellets

Pelleted seeds are available for purchase. Freshly pelleted seeds have been tested and found to be fully satisfactory for viable numbers of *Rhizobia*. However, pellets prepared months before and stored in warehouses may have low numbers of viable *Rhizobia*. Ask for information regarding pelleting date and length of time in storage.

Alternatives to pelleting for acid soils

Most nodulation research in western Oregon has been with subclover on acid soils. Results indicate that if the soil has been limed or the pH is 5.5 or higher, efficient inoculation without lime pelleting is possible. If the pH is 5.2 to 5.5, however, lime-pelleted seeds are beneficial in providing effective nodulation. If the pH is below 5.2, the soil should be limed or a mixture of superphosphate and lime used to neutralize the acidity of the fertilizer. This will improve the survival rate of the *Rhizobia*. A successful neutral medium is a mixture of equal parts of superphosphate and lime, which after a week becomes near neutral. When inoculated seeds are sown in contact with the mixture, near 100 percent effective nodulation is achieved.

There have been some difficulties in drilling the neutral mixture in certain drills. However, with sufficient stirring or agitation, it can be used successfully.

Nutrient availability

The use of small amounts of lime to ensure inoculation of clovers on acid soil will not signifi-

cantly alter soil pH or nutrient availability. Molybdenum is often deficient in acid soils and is made more available to plants by liming to raise the soil pH. Since lime pelleting does not significantly change soil pH, molybdenum may need to be applied for successful production of clovers on acid soil. Consult OSU Fertilizer Guide 4 for recommendations based on soil test data.

Conditions where pelleting is recommended

1. Sowing seed into dry soil.
2. Aerial sowing or any surface sowing with dry conditions.
3. Sowing inoculated seed in contact with superphosphate or other acid fertilizers. This may be avoided by band placement or by putting the fertilizer on separately, before or after sowing.

Lime pelleting is most common in western Oregon, since pelleted seeds provide a microenvironment suitable for survival of *Rhizobia* in acid soils.

Experiment first

Before attempting to lime pellet a large quantity of seed for the first time, it is recommended that small scale trial runs be made using a handful or up to a pound of seed. Use the same procedure in a small container, pouring on the slurry and mixing by hand, then adding lime as needed. This will help to correct mistakes in the amount of slurry or lime used. Once lime pellets have been made successfully, scale up appropriately for the amount of seed required.

The use of trade names in this publication does not constitute an endorsement of these products by the Oregon State University Extension Service.

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