The “why” and “how” of cover crops inoculation

It feels like only yesterday that we planted the first round of cover crops on your farm. Welcome to year two! This document will discuss the following topics:

- Benefits of cover cropping
- Legume vs non-legume cover crops
- What is an inoculant?
- How inoculants work
- How to inoculate cover crops seeds
- How to plant inoculated seeds
- What are we planting this year?

The Benefits of Cover Crops

There are many cover crops and many ways to use them. The following four benefits are important to our project:

Natural Fertilizer

It is not unreasonable to say that we “swim” in an ocean of nitrogen. Nearly 80% of the air we breathe is nitrogen gas (N₂). Some cover crops convert atmospheric nitrogen into ammonia nitrogen that plants can use. Nitrogen is one of the key ingredients of any fertilizer.

In addition, when plants like tomato are harvested, a significant amount of residual biomass nitrogen is left behind in the soil. In the absence of a cover crop, this nitrogen will be mineralized and lost during the winter. Cereal grains with their fibrous roots are very effective at scavenging this nitrogen (and some of the nutrients) that is left over in the soil.

Improve Health of Soil

The health of your garden is directly related to the health of your soil and a key component of a healthy soil is the availability of organic matter.

Organic matter “opens” the soil structure allowing air to reach the roots of the plants. It also increases the soil’s water-holding capacity and acts as both short and long term storage of plant nutrients.

Our soil structure is mostly dense clay. Cover crops add organic matter to soil in two ways: 1) the deep penetrating roots of the cover crop grow through the soil, breaking up compaction. Once cover crops are harvested, the root system remains in the soil and 2) the large volume of biomass that is produced by cover crops above the ground can be incorporated into the soil, increasing the level of organic matter in the soil.

Eliminate Herbicides

Weeds and gardens go together. One of the easiest ways to fight weeds is to suppress them with cover crops. Some cover crops can smother weeds by outcompeting them for water and nutrients. The leafy canopy of cover crops can block the light needed by low growing weeds. Some cover crop roots naturally form compounds with herbicidal properties.

Managing Pests

A diverse mixture of cover crops helps fight pests by 1) creating a habitat for beneficial insects, 2) hosting beneficial microbes that discourage diseases, 3) creating an inhospitable environment for many soil born diseases, and 4) creating compounds that reduce nematode pest population while encouraging beneficial nematodes species.

There are many more benefits to cover crops, such as prevention of soil erosion, removal of excess surface water (earlier drying of the fields in spring) and protecting the ground water quality by removing excess soil nitrogen. In short, cover crops are the unsung heroes of sustainable farming.

Legume and Non-legume

For soil building purposes, it is best to use a mixture of cover crops. Generally speaking cover crops are divided into two categories each with its specific benefits.

Legume cover crops are used to 1) fix atmospheric nitrogen into the soil, 2) reduce soil erosion, 3) host beneficial insects, and 4) add organic matter to the soil.

Non-legume cover crops are used to 1) scavenge nutrients left over from a previous
crop, 2) reduce soil erosion, 3) suppress weeds, and 4) produce large amounts of organic matter for the soil.

What Is An Inoculate?
The short answer is that an inoculant is a bacteria that is applied to seeds before planting.

How Do Inoculants Work?
To understand the role of inoculants, it’s useful to understand how legumes convert nitrogen from air into the soil (this is called “fixing” nitrogen, or “nitrogen fixation”).

The key agent here is rhizobia bacteria. When a legume is planted in soil that contains rhizobia bacteria, a symbiotic (mutually beneficial) relationship is formed between the bacteria and the plant. The plant forms a protecting tissue around the bacteria and feeds the bacteria with carbohydrate, and in turn the bacteria converts nitrogen from the atmosphere into nitrogen that plants can use to build protein and other compounds needed for growth. Isn’t this amazing?

The only trick is that each legume requires a specific strain of rhizobia. For example the inoculant for Crown Vetch will not work for the Purple Vetch and the inoculant for Sweet Clover will not work for White Clover.

How to Inoculate Seeds
Right Inoculant - Since each legume needs a specific strain of rhizobia bacteria, be sure to buy the right inoculant. You can buy the inoculants from the same place you buy cover crop seeds. Keep in mind there is not such thing as “universal” inoculant. These products are actually a blend of bacteria and are not as effective.

Living Bacteria - Bacteria work only if they are alive. Use basic caution for keeping bacteria alive. Buy fresh inoculant, use it right away, keep it out of the sun and do not expose it to heat. Store it in a cool, dry place.

Grains and Vetch
Most of the Vetch, including Purple Vetch that we are using this year, will grow to about one or two feet tall when planted as a single crop (monoculture) and then, being a weak-stem plant, it will fold over itself creating a matted carpet of biomass. However if Vetch is grown in a mix with taller cover crops, such as grains or grasses, it will use the strong-stem plants as scaffolding and will reach 3 to 6 feet in height. This simple technique can double the amount of nitrogen that is fixed in the soil.

What Are We Planting This Year?
Our supplier, Peaceful Valley, sells a cool season Organic Soil Builder Mix. It’s a combination of Bell Beans, Magnus/Winter Peas, Purple Vetch and Cayuse Oats. We have added 15% Cereal Rye to this combination. The seeds are inoculated with Pea Vetch Lentil Inoculant made by INTX Microbials.

Other Resources?
The University of California’s Sustainable Agriculture Research and Education Program has an extensive database of cover crops where over 400 cover crops geared to the Mediterranean climate of California can researched.

National Sustainable Agriculture Information Service has an excellent Overview of Cover Crops that can also be downloaded as a PDF.
How Much?
Most inoculants are sold in a powdered form with peat as the inert carrier. Read the label to determine the rates of application. However keep in mind that while using too little inoculant may be ineffective, there is no harm in using too much of it.

How to Apply?
Inoculants are applied directly to legume seed so that rhizobia bacteria are readily available to colonize roots as seeds germinate. The basic application requires covering the seeds with a “sticking” agent such as coco oil diluted in non-chlorinated water. However a simpler solution is to mix two tablespoons of corn syrup or molasses (or even pancake syrup) in one quart of milk. Lightly spray the seeds with this mixture, spread the recommended amount (or more) of the inoculant on the seeds and mix well. Plant the seeds as soon as possible. Re-inoculate any seed that was not used within 24 hours.

Finally
Once the seeds are covered with inoculant, broadcast the seeds on the soil and cover the seeds using a rake and irrigate immediately. If straw is available, a good solution is to cover the seeds with moist straw.