

UK COOPERATIVE EXTENSION SERVICE

Seed Diseases and Their Treatment/Prevention

Introduction

Seed saving is an ancient practice that has seen a major resurgence in use these last few years. With growing concerns over the stability and long-term survivability of many modern seed stocks, farmers and gardeners the country over have turned to seed saving to insure access to a diverse range of crop seeds. The COVID-19 pandemic that began last year has also attracted many other small-scale farmers and hobbyist gardeners looking to save costs on seed purchases during a financially turbulent time.

Unfortunately, saved seed stocks are at risk to several different viral, bacterial, and fungal infections that can render entire stocks unusable. Seed diseases also cause deformations such as leaf wilt and stem rot in plants that do sprout from infected seeds.

Knowledge of these diseases and the methods to prevent or treat them is also not widespread, as seed saving is still a niche practice. It is here we find the purpose of this referral document, to provide information on the four most common seed diseases, and to describe effective treatment and preventive

measures. For your convenience, this document will be divided into two primary sections, Seeds Diseases and Treatment/preventive techniques.

Seed Diseases

This section of the document will be dedicated to cataloguing and describing the four most common types of diseases that afflict seeds. In order, we will be covering the diseases of: *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Fusarium*. Each Disease will have its own dedicated section that discusses what the disease is, how it spreads, its symptoms/appearance, and the specific plant seeds it infects.

Phytophthora

Phytophthora is a fungal infection that often manifests in pre-emergence seeds (seeds that have not yet germinated). The plant that is primarily affected by this

disease in Kentucky are soybean seeds. Seeds infected with *Phytophthora* will often display spots similar to the color of rusted metal. These spots will also be soft to the touch and leak brownish fluid. This fungal disease occurs most often in soil that is damp and wet, so seeds gathered from soil with these traits are more likely to be infected. See **figure 1** for a visual example of a seed infected with *Phytophthora*.



Figure 1 Phytophthora Infected Seed

Pythium

Pythium is a form of oomycete that parasitizes many different forms of plants and plant seeds. In eastern Kentucky, the primary victims of this plant parasite are corn and corn seeds. Seeds afflicted with this pathogen will often manifest fuzzy brown growths on the seed coat. Infected seeds will also be abnormally soft to the touch in comparison with healthy seeds. Corn Seeds infected with *Pythium* will often germinate seemingly healthy and develop normally. However, after three to four weeks of growth, corn grown from infected seeds will begin to display symptoms such as: root rot, leaf wilt, discoloration, and growth stunting. For an example of a corn seed infected with *Pythium*, please refer to **figure 2**.

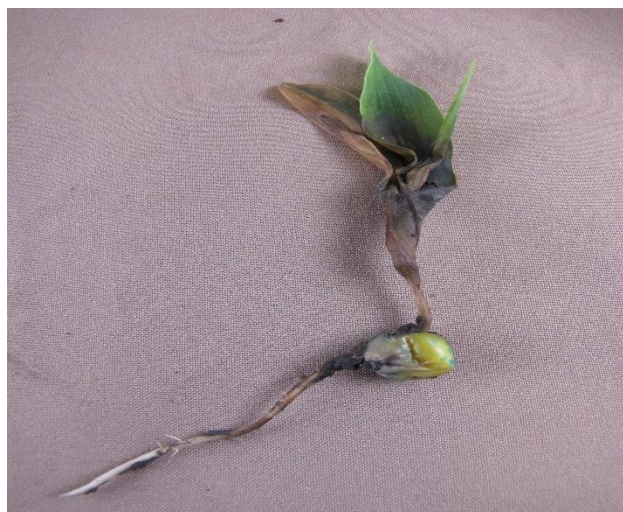


Figure 2 Corn Seed with Pythium

Rhizoctonia

Rhizoctonia is another common disease of soybean seeds. As soybeans have gained popularity among both large-scale and small-scale farmers, occurrences of this disease have also increased in Kentucky. This disease is unique among the seed

diseases we have discussed so far in that it does not cause seed rot or malformation. Rather, this disease only becomes active after an infected seed has germinated into a seedling. This behavior makes *Rhizoctonia* difficult to notice before planting, as infected seeds show no obvious symptoms to help identify the disease.

Once sprouted, seedlings infected with this disease will often display soft brownish lesions on the root stem. These lesions can interfere with the plants growth cycle, resulting in stunting and malformation. Lesions can also occur on the stem of the soybean, those these are often harmless to the plant, and do not interfere with soybean growth. An example of seedling blight caused by *Rhizoctonia* is depicted in **Figure 3**.



Figure 3 Rhizoctonia Soybean Blight

Fusarium

Fusarium is a large genus of filamentous fungi, which are often referred to as hyphomycetes. Most fungi in this genus are harmless and present no danger to crops or gardens. However, the pathogen *Fusarium Graminearum* is of concern to Kentucky farmers who save wheat and barley seeds for replantation. This specific pathogen causes *Fusarium Head Blight (FHB)* in barley and wheat. This disease can infect both fully grown wheat and seeds. In seeds, FHB can delay germination or prevent it entirely. In adult wheat crops, FHB causes premature bleaching of seed spikes. As the disease

progresses, the fungus will begin to colonize the wheat grain, which will begin to shrink and shrivel and adopt a rough texture.

Figure 4 shows a wheat crop infected with FHB.

In wheat seeds, FHB will manifest as pinkish scabby growths on the seed coat. Please see **Figure 5** for an example of FHB afflicted wheat seeds.



Figure 4 Fusarium Head Blight Seed



Figure 5 FHB Seeds

Prevention Techniques

As with any other form of disease, it is better to prevent them than to treat them. Fortunately, there are some steps you can take to prevent the spread or onset of disease. In this section of this referral document, we will examine the different kinds of preventive measures you can take to ensure that your seeds stay healthy and disease free.

Check seeds before Storage!

This may seem like a simple suggestion, but some time dedicated to examining your seeds before you place them in storage can save you a world of trouble later. Most

seeds infected with seed diseases will show symptoms that can be identified easily with a quick examination. Lesions, discolorations, orders, abnormal softness, and growths are all indicators of seed disease. Placing the seeds you intend to save on a flat surface under a bright light can make this process easier.

Freezing

Freezing seeds is an excellent way to prevent disease among saved seed stocks. Freezing seeds will often eliminate any

fungal or bacterial pathogens present on the surface of seed coats. This can prevent the spread of these pathogens to other stored seeds. Freezing seeds also has the benefit of extending the time your seeds can be frozen, so this technique is a good choice for those with a large stock of saved seeds they do not plan to plant in the same season. The frozen seeds can be safely stored in any freezer, including the one in your kitchen. Before you freeze your seeds, there are a few steps you should take to ensure your seed stock is not damaged.

Step 1: Take time to ensure that the seeds are thoroughly dried before freezing. Moist or damp seeds can split or crack open during the freezing process.

Step 2: Place the frozen seeds in an airtight container, such as a Ziplock bag. Check the seals on your chosen container before placing the seeds in the freezer. Improperly sealed seeds may suffer freezer burn in storage, which will render the seeds unable to germinate. **Figure 6** contains an example of a proper storage container for your frozen seeds.



Figure 6 Freezable Ziplock Bag

Step 3: Once the seeds have been placed in their airtight container, position them towards the back or bottom of your freezer to protect them from temperature fluctuations that may damage the seeds.

Step 4: When you are ready to defrost your frozen seeds, avoid doing so in areas with humid air, as this may damage your seeds upon removal.

Seed Treatments

If you fear that a seed disease may have already infected your saved stock, don't worry, there are a number of treatment techniques and procedures you can implement to save your seeds.

Pre-Treatment

Before you begin to treat your seeds, there are a few things you should know before you begin treatment.

- If you are inexperienced with applying seed treatments, consider starting with a small sample of your saved seeds at first. This will allow you to perform your first treatment without fear of spoiling your whole stock due to a mistake.
- If you plan on conducting a hot water treatment on your seeds, consult the seed temperature tolerance graphic before you begin this treatment. Different forms of seeds have differing heat tolerances, placing seeds in water they can not tolerate will result in seed damage.
- Only apply one chosen treatment technique to your seed stocks. Using multiple different treatments, such as hot water and fungicide treatments on the same batch of seeds will most likely damage them.
- Cucurbit seeds (cucumbers, pumpkins, summer/winter squash watermelons, muskmelons) are unsuitable for hot water treatment

and instead should be treated using chemical/fungicidal methods.

Bleach Treatment

The first and most basic chemical treatment for your seeds is bleach treatment. Bleach treatment is an effective way to remove any microbial pathogens that may be present on the coats of your seeds. However, bleach treatment is ineffective against diseases that have penetrated through the seed coat and into the seed itself. If you suspect that a seed disease has broken through the seed coat, see the Hot Water Treatment Section of this document instead. Now that we have the necessary information, let's walk through the steps of this treatment.

Step 1: Place one quart of bleach and five quarts of filtered water into a sterilized container.

Step 2: Add your chosen seed stock to the bleach/water solution and carefully stir them for one to two minutes. For each new batch of seeds you wish to clean, a new solution of bleach/water must be produced.

Step 3: Once cleaning is complete, wash the removed seeds with cold water for roughly five minutes.

Step 4: After the seeds are washed, place them on a clean surface to dry. Clean towels, paper towels, or drying sheets will suffice.

Fungicide Treatment

One of the more effective seed treatment options is fungicide. Fungicide is especially effective against diseases such as Fusarium and Phytophthora. However, be aware that fungicidal treatments are almost always harmful to humans and animals as well as seed borne fungal infections. If you plan on applying a fungicide to your seeds, you must take special precautions to ensure that no person or animal will accidentally ingest the treated seeds. To avoid any potential harm, place seeds treated with a fungicide in a specially marked container that identifies that the seeds within have been treated with a fungicide. Due to the risks of using fungicides, and the effectiveness of other less dangerous treatments, fungicide is not recommended as an effective treatment for smaller batches of seeds for garden use. Fungicides are best used for larger farms or commercial enterprises.

Hot Water Treatment

When considering non-chemical seed treatments, the Hot Water Treatment is both the most effective and safest to implement. However, Hot Water Treatment is also the treatment that carries the most risk for inadvertent seed damage or destruction. The major risk time for your seeds during Hot Water Treatment is during seed boiling, as different vegetable and fruit seeds have specific temperatures that they will tolerate, as well as varying lengths of time that they can be submerged in boiling water without being damaged. For your convenience, this document includes a table with the relevant information on the boiling time and heat tolerance of common garden seeds. **Note:** This treatment is one of the more expensive ones, as certain required items, such as water baths, can cost upwards of \$120 dollars. If expenses are an issue for you, you may want to consider a different cheaper treatment, such as the bleach treatment on page 6.

Preparation for Hot Water Treatment

Before you can begin to use the Hot Water Treatment, you will need to acquire the necessary items listed below.

Needed Materials

- At least two Hot Water Baths
- Thermometers
- Coffee Filters
- Some form of timer (such as the one in your mobile phone)
- Drying plates
- Paper towels
- Tongs
- Stapler
- Pencil/pen

With these items in hand, you are ready to begin treating. Make sure to consult **figure 7** for heat tolerance and the length of treatment time for each seed you treat.

Seed Type	Temperature (°F)	Treatment Time (minutes)
Broccoli	122	25
Cabbage	122	20
Carrot	122	25
Collards	122	20
Cucumber	122	20
Eggplant	122	25
Lettuce	118	30
Mint	112	10
Onion	115	60
Pepper	125	30
Radish	122	15
Spinach	122	25
Tomato	122	25
Turnip	122	20

Figure 7 Seed Information Table

Treatment Process

Now that you have the required items and information, you can begin the hot water treatment itself.

Step 1: Heat one of your water baths to 100°F. This bath will be used to preheat your seeds before placing them into the actual treatment bath. Heat your other water baths to the temperature needed for your seeds. (See figure 7)

Step 2: Deposit the seeds you wish to treat into the coffee filters and staple them closed. Make sure to mark your coffee filters with kind of seeds it contains.

Step 3: Place your seed packet into the 100°F bath for 5 minutes.

Step 4: Once five minutes have elapsed, remove the seed packet from the first bath and place into the bath you have prepared with the appropriate temperature for that seed type.

Step 5: Once the treatment time has elapsed, remove your seed packet from the bath and place the seeds onto a plate covered with a paper towel to dry. After the seeds are finished drying, place them into a storage container such as Ziplock bag to be stored in a cool dark place. A refrigerator is a suitable storage location.

With this process complete, you have completed a Hot Water Treatment round for your seeds. Any seeds treated with this method should now be disease free, and ready for planting next spring.

Conclusion

Seed saving is a fun, economic, and rewarding activity that any gardener can partake in. Armed with the information in this document, you too should now be able to make your seed saving practical and affordable without worrying about diseases ruining your seed stocks.

References

<https://extension.umn.edu/pest-management/soybean-seed-and-seedling-diseases>

Soybean seed and seedling diseases. (n.d.). Retrieved March 13, 2021, from How to treat seeds. (n.d.). Retrieved March 11, 2021, from <http://www.knowledgebank.irri.org/step-by-step-production/pre-planting/seed-quality/how-to-treat-seed>

Corn Seed with Pythium, Accessed 15 March 2021, [Seed Decay and Seedling Blight of Corn ...cropprotectionnetwork.org](https://www.cropprotectionnetwork.org/seed-decay-and-seedling-blight-of-corn)

Fusarium Head Blight Seed, Accessed 8 March 2021, <https://fyi.extension.wisc.edu/fieldcroppathology/fusarium-head-blight-scab-of-wheat/>

Images

Guihua Bai, FHB Seeds, Accessed 9 March 2021, <https://medcraveonline.com/APAR/fusarium-head-blight-and-crown-rot-on-wheat-and-barley-losses-and-health-risks.html>

D. Mueller, Rhizoctonia Soybean Blight, Accessed 9 March 2021, <https://cropprotectionnetwork.org/resources/articles/diseases/rhizoctonia-seedling-blight-and-root-rot-of-soybean>

Alison Robertson, Phytophthora Infected Seed, Accessed 11 March 2021, <https://www.seedquest.com/News/releases/2007/march/18814.htm>