Field Conditions and Planting

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Every year in eastern Nebraska we seem to deal with cold and/or wet soils during planting. This limits the windows of opportunity for good planting conditions and many operations will push the limits when getting their crops in the ground.

Check Soil Temperature

It is best to check the soil temperature in your field down to a depth of 4 inches. You can use the Nebraska Mesonet (*https://mesonet.unl.edu*) or CropWatch (*https://cropwatch.unl.edu*) to find soil temperatures at a nearby station. The sources listed above provide a daily average soil temperature and a 7-day average soil temperature. It is important to check temperatures daily and try to get a 7-day average near the optimal temperature of 50°F. Check the soil temperature at the same time each day (do it in the morning) because the temperature can vary significantly throughout the day, especially in bare, dry soils, which can vary 10–15°F from morning to afternoon.

Cold Tolerance of Seeds

Before planting, check the seed tag or check with your dealer regarding the cold tolerance of your hybrid/variety. Hybrids and varieties vary in their cold tolerance and those that are more cold tolerant should be planted first.

Tyler Williams, Nebraska Extension in Lancaster County

Soil temperature can be measured using an inexpensive thermometer.

Imbibitional chilling, which is when the seed takes in water below 50°F (likely in the mid-to low-40s) within 48 hours of planting corn (24 hours of soybeans), can impact seed germination and growth, so pay close attention to the weather forecast. Soil temperatures dropping below 50°F after that 48-hour window do not create as big of an issue.

Optimal Planting Date

Many use a calendar date for planting, often based on the crop insurance date; however, the soil temperature can vary significantly from year to year, so this may not be the best method. For example, for the last 30 years, the soil temperature at the Eastern Nebraska Research and Extension Center near Mead on April 10 of each year averaged 49°F, but ranged from 37°F (1997) to 61°F (2011). The average temperature for this station-date is near the optimal planting temperature, but the variation is significant.

Research done in Iowa has shown the optimum planting windows for corn, to obtain at least 98 percent yield potential, range from April 17–May 8 for southwest Iowa (closest location to southeast Nebraska). The optimum window for soybean planting is late-April through mid-May, again, if conditions and forecasts are adequate.

Increasing Wetness

Moisture conditions in your field will also play a role in finding the optimum planting window. Planting in wet soils can cause tire compaction, side-wall compaction, tire ruts, etc. There may also be a risk of soil-borne pathogens if soils remain saturated for an extended period after planting.

Opportunities for dry weather keep getting smaller and smaller over time due to an increasing precipitation trend in the spring. In 2015, Shulski, et al. found that 68 percent of the stations in Nebraska showed a significant trend of 8 more days of measurable precipitation in the spring (from 1895–2012). Just in the month of April, every climate division in Nebraska has seen an increasing 30-year trend of >0.4"/decade of precipitation (1987–2016). This equates to nearly an extra 1.5 inches of precipitation in April, as compared to 30 years ago.

Obviously, finding an extended period of optimum planting conditions is challenging, so take advantage of any window of opportunity with soil temperatures remaining above 50°F for 48 hours and adequate soil conditions. Large planters, auto-steer and other technology should help increase the number of acres covered in a short window.

AgriTools Mobile App

Nebraska Extension's AgriTools mobile app is a useful tool, which uses your GPS location to look at interpolated soil temperature from the Nebraska Mesonet. The app provides the 5-day forecast from the National Weather Service, among other information. AgriTools is available for iPhone and Android devices.

Sources:
- *Shulski, et. al. 2015. A Historical Perspective on Nebraska's Variable and Changing Climate. Great Plains Research 25 (Fall 2015): 109-120*
- *NOAA National Centers for Environmental Information, Climate at a Glance: Global Mapping.* www.ncdc.noaa.gov/cag
- *High Plains Regional Climate Center – Web Data Access.* https://hprcc.unl.edu
- *CropWatch, University of Nebraska-Lincoln, Institute of Agriculture and Natural Resources.* https://cropwatch.unl.edu
- *Nebraska Mesonet, Nebraska State Climate Office, University of Nebraska – Lincoln.* https://mesonet.unl.edu

Beneficial Fungi and Tree Health

Sarah Browning
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Tree health is often a reflection of root health. Good practices to improve root health include properly applied organic mulch, good water management, and avoiding root damage from construction or changes in soil grade.

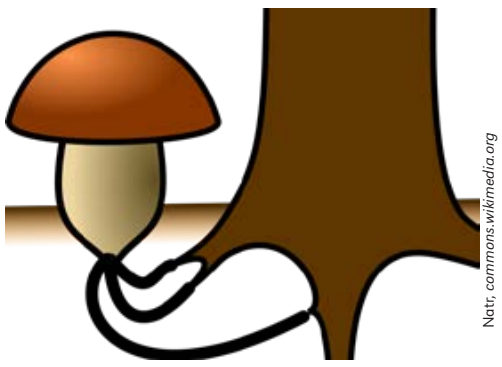
Another major contributor to tree health, often unseen and unknown to gardeners, are a vast array of beneficial soil fungi working in harmony with trees to create a win-win situation for both organisms. These beneficial organisms are called mycorrhizal fungi, which comes from Greek "myco" fungus and "rhizae" root, translating to fungus roots (plural — micorrhizae).

Have you ever raked back mulch beneath a tree and found a spider's web of slender white branching "hairs" covering the soil surface? Those were fungal roots, most likely from mycorrhizal fungi.

What Are Mycorrhizal Fungi?

There are many species of naturally occurring micorrhizae. When a tree is planted, fungal roots grow toward, attach themselves to and enter the tree's roots. This connection essentially makes them an extension of the tree's root system. Mycorrhizal fungi collect water and nutrients from the soil and pass them to the tree. In exchange, the tree gives the fungi food, in the form of carbohydrates the tree has manufactured through photosynthesis.

The natural state of trees is to be "infected" with mycorrhizal fungi and a tree often has several different species of fungi associated with its root system. Two types of fungi commonly associated with trees are ectomycorrhizae (EM) and arbuscular mycorrhizae (AM, also syn. endomycorrhizae).



Natr, *commons.wikimedia.org*

Beneficial fungi pass water and nutrients to trees in exchange for food — in the form of carbohydrates created by the tree.

EM grow into a tree's root by pushing between the outer cortical cells. They can also form a thick, outer layer on tree root hairs, which is visible to the naked eye. Each EM fungal species tends to form an association with a specific tree species. Trees colonized by EM include fir, hemlock, pine, spruce, alder, aspen, beech, birch, hickory, linden, oak and poplar. These fungi reproduce through spores produced on mushrooms and puffballs, which can easily move through the air and recolonize disturbed soil.

AM fungal roots enter into tree root cells and are so small they cannot be seen without a microscope. In contrast to EM, AM fungal species are generalists and can associate with hundreds of host species. Tree species colonized by AM include apple, arborvitae, ash, buckeye, catalpa, cedar, cherry, cypress, dogwood, elm, gingko, hawthorn, juniper, magnolia, maple, redbud, redwood, serviceberry, sycamore, sweetgum, tulip tree, viburnum and walnut. They reproduce through soil-borne spores, which are not spread as easily through the wind as EM. Tree species highly dependent on these fungi can exhibit slower growth when planted on disturbed soil if low quantities of fungi are present.

How Do Mycorrhizal Fungi Benefit Trees?

Water and nutrient uptake. How much can fungal roots expand the total reach of a tree's root system? Estimates range from five times the normal spread of a root system and up. This results in increased water and nutrients available to the tree for growth, defense or storage at a reduced energy "cost" in terms of the amount of carbohydrates the tree has expended to access those resources.

Pest and disease resistance. Some mycorrhizal fungi can outcompete other harmful fungi and act as armor around fragile roots protecting them from infection. Others produce antibiotic compounds to protect roots from soil pathogens.

Survival on harsh sites. Some fungi help trees tolerate difficult sites with high or low pH, high salt, low fertility or contain heavy metals. Exactly how mycorrhizal fungi do this is not yet well understood, but much of the benefit comes from increased water and nutrient uptake.

Encouraging Mycorrhizae in Your Soil

Many of the practices used to create good tree growth, also encourage fungi growth.

Use landscape fungicides carefully. Foliage sprays of fungicide don't have a high impact on soil fungi, but avoid soil drench applications of systemic fungicides. These can stop the growth of beneficial fungi, as well as the bad guys.

Limit fertilization. High soil fertilization actually reduces fungi growth. Avoid large applications of fertilizer, especially those high in nitrogen and phosphorus.

Maintain native fungi populations. Tilling, removing plant litter and debris, heavy fertilizer applications and the use of systemic soil drench fungicides all reduce natural fungus growth.

John Ghent, *Bugwood.org*

Ectomycorrhizal fungus fruiting bodies growing among spruce seedlings.

Maintain even soil moisture. Fungal roots dry out and die if soil conditions get very dry during periods of drought. Applying water to maintain the tree's health will also encourage continued functioning from mycorrhizal fungi.

Apply mulch beneath trees. Fungal roots grow better under organic mulch (wood chips, bark chips, pine straw, etc.) than in turfgrasses.

Is it worthwhile applying mycorrhizal fungal inoculates from your local nursery to plants in your landscape? Research hasn't provided clear answers yet, but is ongoing. Applying them won't hurt plants, but for now, the benefits of these products compared to their cost suggests just using good tree care and management practices provides a more reliable benefit to help both the tree and native fungi grow best.

FOR MORE INFORMATION

The Nebraska Forest Service has information, How To Care For Trees, at *https://nfs.unl.edu/tree-care*