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Checking the Back Forty

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Alfalfa Too Cold To Grow

In the spring we often focus on the need for dry soils and warm temperatures to plant and grow corn. No one is usually wishing for temperatures to warm up so they can begin first cutting sooner. If any thing we would like that first cutting to hold off so we can get corn planted first. But alfalfa does need heat to grow and there has been very little to its liking available this spring.

Just like corn, we can measure the heat units needed to grow alfalfa by utilizing growing degree days (GDDs) only with alfalfa we use a base temperature of 41° F instead of a base of 50° F. Table 1 should look familiar to past readers of Checking the Back 40 as it has been used to demonstrate growing degree days for corn and it will be used for that again. But it serves the purpose well to demonstrate lack of growing degree days for alfalfa since the beginning of March. The GDDS listed for May 11 are actually all at or below the lowest recorded for that day. So not just below the 15 year average shown here or the 30 year average that but those numbers are likely to be the new lowest recorded for that location.

Table 1.
Growing Degree Days (GDDs) Base 41° F for select locations in the 8 county team region through 5/13/2020.

		Start Date March 1	
Location	**Elevation**	**GDDs 5/13/2020 Base 41**	**GDDs 15 year avg Base 41**
Bainbridge	1000	153	324
Bouckville	1170	121	324
Canastota	420	232	431
Cherry Valley	758	166	382
Cobleskill	937	163	346
Frankfort	530	135	333
Fultonville	489	244	442
Galway	749	197	369
Oneonta	1107	152	340
Richfield Springs	1580	86	274
Saratoga Springs	365	200	381
Sherburne	1115	167	333
St Johnsville	650	106	302
	Average	163	352

There is a quality end point also for alfalfa. Look to 680 GDDs Base 41°F to bring you to about 38% NDF. We have been looking at alfalfa height as an indicator of quality which has worked out pretty well in our experience but having GDD information available makes that another option.

The source for GDDs here is the Climate Smart Farming Growing Degree Day Calculator:

http://climatesmartfarming.org/tools/csf-growing-degree-day-calculator

Cold temperatures have not only slowed growth but have stressed alfalfa in other ways such as frost, last nights low temperatures being a good example. So I have included several articles on frost damage to alfalfa in this issue.

Spring Frost Damaged Alfalfa

Field Crop News, April 10, 2020
Joel Bagg, Retired Forage Specialist, Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)

Alfalfa frost damage can sometimes occur in the spring after growth has started, resulting in damaged growing points. Some wilting can be visible about 24 hours after frost or some yellowish or brownish discoloration 3 or 4 days later. The top of the stems will typically bend over with a "shepherd's hook". Damage is often minimal and plants will grow out of it, but some yield loss and development delay can result. Thin alfalfa stands are more susceptible to frost damage.

"Light Frost" Damage

The extent of frost damage to the alfalfa will depend on the severity of the freezing. Temperatures in the plant canopy level are usually "layered" and higher than reported "air" temperatures. Soil temperatures, slope, wind and the microclimate within a field can all have an effect. In mild cases, leaves at the tops of the plants become wilted and discoloured, but plants should completely recover. If the "shepherd's hook" straightens, normal growth resumes. Frosts of as low as -3ºC can freeze leaf margins (resulting in white spots on leaves), but not damage stems or growing points.

"Heavy Frost" Damage

In more severe cases, alfalfa stems freeze to various degrees and growing points are destroyed. Growth of alfalfa is from the tip of the stem where the growing point is located within a dense cluster of unfolded leaves. Temperatures below -4ºC for 4 hours or more will damage growing points and stems will die. However, it would take a lot of hard frost to kill an entire alfalfa crown and this very rarely occurs.

Frost damaged alfalfa plants usually recover and regrow from:

1) axillary buds on lower parts of the plant (if lower stems are not damaged), and/or
2) newly formed crown buds.

In most cases, axillary buds will become the main growing point if the terminal buds are damaged.

Forage Crop Impacts

Plants use up some of their root reserves for their initial spring growth. After growing points are frozen, these plants will then have to initiate regrowth from new crown or axillary buds. This will delay the growth and developments of the crop as well as use up more of the remaining root reserves. Healthy stands will recover more quickly. Depending on weather conditions, some first-cut yield reduction and a delay in maturity can be anticipated. Where damage is uneven across a field, there can be some unevenness in maturity. If possible, delay cutting of severely affected fields to allow rebuilding of root reserves and full recovery.

Should I Cut It Now?

There is usually no benefit to cutting frosted plants. Cutting will not enhance recovery and forage quality drops rapidly. Severe frost kills the growing points, the same as cutting does. Regrowth would have to come from new crown buds and may further weaken the stand. Yield will be extremely low with poor quality. In extreme cases, frozen alfalfa that is harvested can be at increased risk for high nitrate levels.

New Seedings

Damage to new seedings of alfalfa is usually minimal. Companion crops protect new alfalfa seedlings somewhat against frost damage. Alfalfa generally has excellent frost tolerance up to the cotyledon and unifoliate stage. Some frost damage can occur starting in the first-trifoliate stage. Only a few hours of temperatures below -4ºC can kill alfalfa seedlings at the beginning of the second-trifoliate stage. After contractile growth, where the cotyledons are pulled below the soil surface to form a crown, alfalfa becomes more tolerant again. Observe new seedings for 3-5 days after frost. Plants will initially wilt back. If the entire plant dies back to the ground, it is dead. To survive and recover, one set of leaves must survive. Reseeding may be required if less than 15 – 20 viable plants per square foot survive.

Reference
https://fieldcropnews.com/2020/04/spring-frost-damaged-alfalfa/

Frost Damage to Alfalfa

Dan Undersander, University of Wisconsin Extension

The cold temperatures in early spring can cause some frost damage to alfalfa. Following are recommendations for evaluating damage and taking action.

New seedings: Damage to new seedings has been minimal due to their excellent frost tolerance. To determine if damage has occurred examine plants – they will first appear to wilt and then die over the next 3 to 5 days. If plants die back to the ground, the plant is dead. At least one set of leaves must have escaped damage for recovery to be expected. Determine the number of living plants per square foot. If more than 20 plants per square foot remain, stand will survive in good shape. As stands are thinner than 15 plants per square foot consider top seeding alfalfa.

Established stands: Evaluate the stands to determine 1) if less than 30 % stem tops are damaged, 2) if most or all stem tops are damaged, and 3) if the stems are frozen back to the ground. Damaged means wilting (usually visible in about 24 hours after frost) or yellow to brown discoloration (usually visible 3 to 5 days after the frost).

1. *If less than 30% of stem tops show wilting/browning from frost, do nothing*. Enough stems remain to provide good growth and yield of first cutting. Stand will have some yield reduction of first cutting but will recover completely on second cutting.
2. *If most or all stem tops are damaged and stand is less than 10 inches tall, do nothing*. The growing points have been killed but the alfalfa will form new buds at lower leaf junctures (axillary buds) and continue growing (first cutting might be delayed). Alfalfa may demonstrate some horizontal growth. Mowing existing top growth will not enhance recovery. If stand is over 12 inches tall, harvest and allow to regrow. None of the alfalfa that was frozen in the Midwest was over 12 inches when frosted to our knowledge. Note that frozen material may be high in nitrate.

Figure 1. Alfalfa leaves brown from frost April 28.

If all stems on a plant are frozen back to the ground, the plant in dead. This extent of frost damage has not occurred in the Midwest to our knowledge. However, if observed and fewer than 5 plants per square foot remain, consider rotating to another crop and replanting alfalfa in another field to avoid autotoxicity.

Reference:
https://fyi.extension.wisc.edu/forage/frost-damage-to-alfalfa/

Will my corn seed rot… or not.

There has been plenty of good weather to get corn planted but not much to make it grow. Despite frost, sleet and snow across our 8 counties we have had relatively little precipitation over the past 2 weeks plus. But the question has already come with concern over will it rot in the ground. I think not but you should be looking all the same if you have corn in the ground.

Had the chance to get a good weather data set from the folks at NYS MESONET:

http://www.nysmesonet.org/

And also a shout to Dan Olmstead at NEWA, Network for Environment and Weather Applications:

http://newa.cornell.edu/

Thanks to Dan for getting this data set and pulling it together.

There is a lot of data much more than can be shared here that would let us hone in on each location but I wanted to pull together a few things that I thought were important

So here is precipitation data and growing degree days GDDs Base 86/50 for corn for 13 NYS MESONET locations in our area. Note these are **soil GDDs not air GDDs** with temperature taken at 5 centimeters or 2inches. There is always concern over using air temperature growing degree days at this stage of corn development and not using soil temperatures.

According to Dr Bob Neilsen at Purdue we need to get to between 35 and 60 Growing Degree Days (GDD) after planting for the root radicle to appear at the tip of the kernel. In Table 2 you can see the GDDs May 1-13 have barely got us to that germination step. To me the positive is that we haven't had a lot of rain in two weeks, so rotting at this point I see unlikely. Even with the chance of several inches rain coming in the next few days the weather warms up a lot and that means soil temperatures will rise and move that germination along. Rot isn't likely to be the issue.

Table 2.
Growing Degree Days (GDDs) Base 86/50° F for select NYS MESONET locations in the 8 county team region May 1-13, 2020

Location	Precipitation May 1-13 in inches	Soil GDDs Base 86/50 °F for corn May 1-13	Lowest soil temp °F since May 1
Ballston Spa	1.0	28	45.9
Brookfield	1.1	3	41.4
Cobleskill	0.5	19	41.1
Cold Brook	0.9	15	40.8
Herkimer	0.6	11	42.6
Johnstown	0.5	15	47.3
Laurens	0.6	6	41.1
Morrisville	1.0	15	38.1
Oppenheim	1.1	19	43.1
Schuylerville	0.7	32	47.3
Sherburne	0.7	22	41.5
Sprakers	0.5	29	39.7
Springfield	1.0	25	41.9

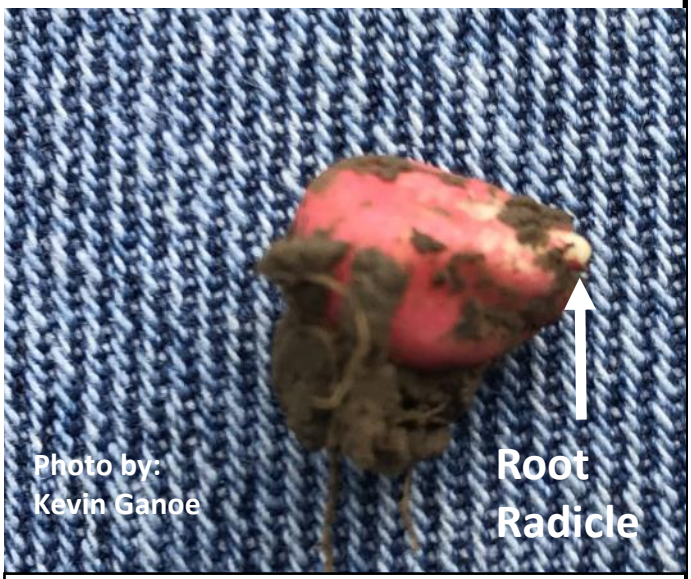

Figure 2. Root radicle just emerging, May 11, 2020

As seen in Table 2 we have had soil temperatures below 50 °F during the past two weeks which have the potential to affect corn seed germination and emergence. What may be of concern is whether of not any of the cold temperatures caused imbibitional chilling and or cold injury.

The difference between the two is described very well by Dr. Neilsen in the below referenced article:

Cold Soils: *Cold soils and/or wide fluctuations in soil temperatures throughout the day during the emergence process are also thought to be major contributing factors for the development of "corkscrewed" mesocotyl development (Buckle & Grant, 1974). The nature of the cold temperature injury appears to be damage to the outer surface layers of the mesocotyl. The elasticity of the damaged tissue is less than healthy tissue. The "corkscrew" elongation of the mesocotyl occurs when the tissue damage occurs unevenly around the circumference of the mesocotyl. The exact minimum soil temperatures that can cause such corkscrewed development are not clearly documented, but clearly it is not uncommon in Indiana for daily soil temperatures to dip as low as 40F (4.5C) during April and early May. Furthermore, bright sunny days can elevate bare soil temperatures quite high but still drop quite low the following night and thus result in a wide diurnal fluctuation in soil temperatures. Dry soils would be more prone than wetter soils to wide swings in daily soil temperatures.*

Imbibitional Chilling Injury: *Cold temperature injury that results in corkscrewed mesocotyls is not exactly the same as that which is referred to as "imbibitional chilling" injury. The latter refers to cold injury to the seed that occurs during the first 24 to 36 hours after planting as the dry seed imbibes (aka absorbs) water. The seed naturally swells in response to the imbibition of water. Cold seed cell tissue is less elastic and subject to rupturing as the seed swells. The threshold seed tissue temperature below which imbibitional chilling injury may occur is not clearly defined in the research literature, but appears to be temperatures cooler than 50F (10C). The most common symptom of imbibitional chilling damage is often simply swollen seed with little to no evidence of sustained germination progress. In contrast, seedlings with corkscrewed mesocotyls probably germinated successfully and subsequently experienced cold temperature injury to the mesocotyl tissue that interfered with normal mesocotyl elongation.*

From: Corny News Network, Emergence Failure of Corn, Updated April 2020
R.L. (Bob) Nielsen Agronomy Dept., Purdue University
https://www.agry.purdue.edu/ext/corn/news/timeless/EmergenceFailure.html

Also: Corny News Network, Cold Soils & Risk of Imbibitional Chilling Injury in Corn, April 16
R.L. (Bob) Nielsen Agronomy Dept., Purdue University
https://www.agry.purdue.edu/ext/corn/news/timeless/ImbibitionalChilling.html