



Ministry of Agriculture,
Food and Rural Affairs

| [central site](#) | [feedback](#) | [search](#) | [site map](#) | [français](#) |

[HOME](#)

[WHAT'S NEW](#)

[CALENDAR](#)

[PRODUCTS](#)

[NEWS RELEASES](#)

Do Soil Temperatures at Planting Impact Soybean Yield?

(This copy reposted to CropWatch.unl.edu in 2019 with permission from the publisher.)

Author: Horst Bohner - Soybean Specialist/OMAF
Creation Date: 05 September 2003
Last Reviewed: 09 October 2003

Many soybean plant stands were thin this year. Insect, disease, and poor seed quality can explain the majority of thin stands, but not all. Soil temperature at planting time may have a bigger impact on populations and final yield than we think. Although seed treatments will help protect against insect and diseases they give no protection against cold soil temperatures.

Seed Imbibition

Soybean seeds are extremely vulnerable to cold soil temperatures especially during the first 6 to 24 hours after planting. Before seeds can begin to germinate they must take in water. This process is called imbibition or rehydration. Seeds make the transition from a dry state in which they have been for several months or years to a metabolically active state within a short period of time. For this reason the soil temperature at planting time and for the next 24 hours is crucial and more important than the temperature following that period. After the initial hours of imbibition seeds become far less sensitive to cooler temperatures.

Initial Soil Temperatures

For Crop Diagnostic Days at Ridgetown College this summer a demonstration was set up to show the possible impact of cold soils on plant stands. Picture #1 shows the results of planting seed into warm soil (25° C) and then keeping it there for 17 days. The plant stand is essentially perfect.



Picture #1. Soybeans that were planted into warm soil (25° C) and kept at that temperature for 17 days.

Picture #2 demonstrates how planting seed from the same bag into cold soil (7° C) may dramatically reduce the plant stand. Interestingly, the seeds were only kept at 7° C for 20 hours and then warmed up to 25° C for the remainder of the 17 days. The reduced plant stand is obvious.



Picture #2. Soybeans that were planted into cold soil (7° C) and kept at 7° C for 20 hours and then warmed up to 25° C for 17 days.

To prove that it was the initial soil temperature that caused the injury in Picture #2 another tray was set up where the soil was warm at planting time (for 8 hours following planting) and then cooled to 7° C for 4 days. After that the soil was again warmed up to 25° C for the remainder of the 17 days. Picture #3 shows how this treatment resulted in no injury to the seed. A full plant stand resulted.



Picture #3. Soybeans that were planted into warm soil (25° C) and kept there for 8 hours. The soil was then cooled to 7° C for 4 days. After that the soil was again warmed to 25° C for the remainder of the 17 days.

The take home message is clear. Planting soybeans into cold soils may have a dramatic effect on emergence. Soil should be at least 10° C at planting and for the following 6 to 24 hours. It is impossible to predict the exact length of time initial imbibition will take since it depends on a number of factors including soil moisture, seed moisture, seed quality, etc. It may be as short as only a few hours or up to a full day. Of course the temperature for the weeks and months following planting are critical for plant health but low temperatures at planting are one of those factors that can set the crop back right from the beginning.

What is Imbibitional Chilling Injury?

The injury demonstrated in the above pictures is called imbibitional chilling injury. If the initial water imbibed by soybean seed is too cold it disrupts membrane integrity, increases electrolyte leakage and may result in lower germination. This leakage may also result in increased pre-emergent damping off, since some pathogens use the leakage as an energy source. Cold temperatures also reduce hypocotyl elongation, which may also lower emergence.

If the seed is very dry or the seed coat is cracked soybeans are even more vulnerable to this kind of injury. A good seed coat is important during imbibition because it moderates the absorption of water and other particles in and out of the seed. When the seed coat is thin or cracked it does not regulate these functions properly, which will increase injury. However, if seeds are placed into warm soils (for 6-24 hrs) which then become cold, no damage occurs to the seed since a large percentage of the water has already been imbibed and cell membranes have had a chance to re-hydrate normally.

Possible Yield Impact?

Research conducted by E.E. Gamble during the 1980's showed that the time of day soybeans are planted may have an impact on final plant stand and yield if soil temperatures are low during the planting season. Morning planting (while the soil was still very cold) and late evening planting resulted in reduced emergence and yield in one trial. The late evening planting had reduced yield and emergence, probably because nighttime conditions after planting were cold. In the most extreme case, when planting occurred at 8:30 a.m. at a soil temperature of 3° C, a yield reduction of 790 kg/ac (11.7 bu/ac) was evident compared to planting at 11:30 a.m. when the soil was up to 10° C. In another trial there was a 168 kg/ha (2.5 bu/ac) increase in yield when comparing a 4:00 p.m. planting to an 8:00 p.m. planting if the following night was cold. In trials where soil temperatures were above 10° C and remained above 10° C after planting, no impact on yield was evident.

Seed Quality

The quality of the seed and the integrity of the seed coat seems to play an important role in chilling injury. Drier seed is more susceptible since it takes in water more rapidly. So, if you plan on keeping soybean seed this fall for next year's crop, take special note of the quality. Keep only the best for seed. Next spring, remember to plant the best quality seed first since low temperatures are more likely in the early part of the season. If soil temperatures are cool consider planting during the afternoon hours of the day.

| [Top of Page](#) |

For more information:

Toll Free: 1-877-424-1300

Local: (519) 826-4047

Email: ag.info@omaf.gov.on.ca

| [OMAFRA Home Page](#) |

| [Central Site](#) | [Feedback](#) | [Search](#) | [Site Map](#) | [Français](#) |
| [Home](#) | [What's New](#) | [Calendar](#) | [Products](#) | [News Releases](#) |



This site is maintained by the Government of Ontario, Canada.

This information is provided as a public service, but we cannot guarantee that the information is current or accurate. Readers should verify the information before acting on it.

© Copyright 2006 [Queen's Printer for Ontario](#)
Last Updated: December 1, 2005