



# Soil Temperature for Germination

Soil temperature can serve as a useful guide for timing spring seeding operations. Once the seed is planted, it is important that germination proceed uniformly and without delay.

If the soil is too cool, germination is delayed, which results in seed damage and uneven or inadequate seeding emergence. It may even be necessary to reseed. On the other hand, if the soil is unusually warm in the spring, it may be better to seed earlier than normal. In either case, the soil temperature at seeding depth can be a practical guide.

## Measuring soil temperature

### Instruments

Any thermometer that will measure temperature at a specific depth can be used to measure soil temperature. This category includes ordinary glass bulb thermometers, provided they are long enough to permit reading the temperature when the bulb is inserted to the required depth.

Thermometers with a temperature scale etched onto the glass itself can be used more effectively than those with an attached scale. If the temperature scale is not etched onto the glass, a permanent marker can be used to mark in at least a few key values. The glass part of the thermometer should then be separated from the manufacturer's scale for taking readings.

Care must be taken to avoid breaking glass thermometers. Before inserting the thermometer into the soil, make a pilot hole in the soil using a rod, screwdriver, etc. of similar diameter as a precaution.

### A representative site

Sites selected for temperature measurement should be representative of the land to be seeded in terms of the following factors:

- **soil cover** – whether stubble, summerfallow, strawcovered, bare, etc. Soil warms from the top down. Bare soil warms most quickly.
- **aspect** (amount and direction of slope) – South-facing slopes warm more quickly than north-facing slopes or level land; snow also melts earlier on these southern slopes.
- **soil moisture** – Dry soils warm faster than wet ones; moisture content is strongly related to soil cover, aspect, texture and drainage.

### Taking readings

- place the bulb or sensing part of the thermometer at the intended seeding depth. In the case of glass thermometers, use a pilot hole to reduce the risk of breakage. The bulb should be in firm contact with the surrounding soil.
- allow a minute or two for the thermometer and the soil to reach temperature equilibrium before taking a reading. If there is bright sunshine, shade the thermometer during this time interval.
- record the temperature.

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Tables 1 and 2 give minimum and preferred temperatures established for a number of crops. These values should be regarded as approximate since germination depends on several factors.

For most crops, there is a temperature range just above the minimum germination temperature where the rate of germination is reduced. Spring seeding should not begin until soil temperature at seeding depth reaches or exceeds the required minimum. **Shallow** depths warm up first. Therefore shallow seeding gives the earliest germination, provided moisture requirements are met.

**Table 1. Germination Temperatures for Field Crops**

	Minimum (°C)	Preferred (°C)
<b>Cereals and Oilseeds</b>		
wheat	4	20
barley	3-5	20
oats	5	20-24
canola/rapeseed	5 (Argentine) 7-10 (Polish)	15-20 15-20
<b>Forage Crops</b>		
alfalfa	1	25
birdsfoot trefoil	1	26
red clover	3	25
sweet clover	1	18-25
white clovers	5	18-20
fescues	3	13-18
orchardgrass	4	18-20
timothy	4	18-22

**Table 2. Germination Temperatures for Vegetables and Special Crops**

	Minimum (°C)	Preferred (°C)
bean	8-10	16-30
beet	4	10-30
cabbage	4	7-35
carrot	4	7-30
cauliflower	4	7-30
celery	4	15-21
chard, Swiss	4	10-30
corn	10	16-32
cucumber	16	16-35
eggplant	16	24-32
lettuce	2	4-27
onion	2	10-35
parsley	4	10-30
parsnip	2	10-21
pea	4	4-24
pepper	16	18-35
pumpkin	16	21-32
radish	4	7-32
rutabaga	4	16-30
spinach	2	7-24
squash	16	21-35
tomato	10	16-30

Soil temperatures at seedbed depths are normally measured twice daily – morning and afternoon. The average daily soil temperature usually lies between the two readings.

Table 3 gives some average monthly soil temperatures at a depth of 5 cm (2 in.) for the months of April and May. These temperatures are included to illustrate typical variations of soil temperature in a general way only. Individual measurements like those described earlier are required to assess the situation in a given year.

Data in this table are based on measurements under grass cover. Afternoon temperatures under a tilled soil would normally be higher.

**Table 3. Average Monthly Soil Temperature at 5 cm (°C)**

	April		May	
	AM	PM	AM	PM
Fort Vermilion	0.2	2.5	8.6	15.8
Peace River	1.3	4.6	8.2	14.2
Beaverlodge	0.3	2.4	6.6	11.9
Vegreville	0.8	3.6	7.2	12.1
Calgary	1.2	6.1	7.1	14.6
Vauxhall	3.2	8.9	10.4	17.5
Lethbridge	4.0	7.9	10.5	16.0