

WHAT IS THE EXTENT OF CROP DAMAGE FROM THE HEAVY RAINS?

Compiled by Staff at Crop Industry Branch, Manitoba Agriculture

When large rain events occur, it leads producers, agronomists, and even media to ask the question "What is the extent of crop damage from the heavy rains?" Unfortunately, there are not many black and white answers available immediately after the excess rains. Field by field assessments over the coming days will give us a better idea of what impact the rains had.

HOW EXCESS MOISTURE RESULTS IN DAMAGE

Germinating seeds and plant roots require oxygen in the soil for respiration. Without oxygen, these living plant tissues cannot perform critical life sustaining functions such as root and shoot development and nutrient uptake. Under flooding conditions, the saturated soil becomes oxygen depleted. When soil oxygen levels drop too low in the soil, plant respiration changes to a pathway similar to fermentation. While some life-sustaining energy is produced during fermentation, energy production is reduced by up to 95 percent. In a nutshell, the main effect of low oxygen is drastically reduced metabolism, which can reduce yield and, if long enough in duration, cause death to a portion or the entire plant.

THE EXTENT OF DAMAGE DEPENDENT ON NUMEROUS FACTORS

Stage of Plant Growth

For crops that have been recently seeded but are not yet emerged, sprouting seeds are vulnerable to flooding/ponding damage as they require oxygen for respiration. The longer it takes for emergence after germination, the greater the chance of stand loss. Saturated soils conditions may also retard or prevent germination because oxygen concentration is too low around the seed.

If no germination has occurred, seeds can be cut in half to determine if turgor pressure is still present. If the seed is extremely soft and does not hold form, it probably won't survive.

For emerged crops, young plants are more susceptible to damage for two reasons. First of all, the growing point for many crops are at or below the soil surface and therefore is directly subject to the stress of oxygen depleted conditions. Secondly, young plants are in the process of trying to successfully establish a vigorous root system. Stunting or death of roots by oxygen-depletion can be a major stress for a plant that is not yet fully established. On the flip side however, a younger plant has a smaller demand for oxygen and may be able to survive better.

To confirm plant survival of emerged plants, check the color of the growing point and look for new leaf growth three to five days after water drains from the field. Healthy growing points will be firm and yellowish-white, not mushy and discolored.

Duration of Saturated Soils

The longer the duration of flooding and/or water-logged conditions, the greater the chance is for injury. Duration of flooding is important because many of the effects of low oxygen on plants are reversible if the duration is not too long. Long durations allow for increased oxygen depletion and the build up of harmful chemicals.

Under flooded conditions, 36 to 48 hours is often the tolerable limit for plants. Under water-logged conditions, crop tolerance and adaptation is plant species dependent. Most annual crops can tolerate 3 to 7 days of water stress. In terms of relative crop tolerance:

- cereal crops: oats > wheat > barley;
- pulse crops: fababeans > soybeans >>> field beans > peas;
- oilseed crops: canola > sunflower > flax.

However, specific information on how long annual crops can survive under excess water has not been widely reported since it is important to remember other factors can influence the tolerance period, such as soil type, soil and air temperature, etc.

Temperature – Both Water & Air

Temperature affects the speed of plant respiration. The faster the respiration, the quicker oxygen is depleted and the sooner the fermentation process begins. Warm water speeds respiration where cold water will slow respiration. As well, if air temperatures are warm (low to mid-20s°C or higher), a young plant's survival chances are reduced. Meanwhile, cooler temperatures and cloudy conditions prolong survival and reduce the amount of damage from flooding, due both to slower growth rates and that more oxygen will dissolve in cool water than in warm water.

Soil Characteristics

Soil drainage properties can aggravate the flooding effect. Soils high in clay content or with other drainage restrictions prolong the wet conditions and can remain waterlogged after waters recede.

PLANTS SURVIVE EXCESS MOISTURE - BUT MAY NOT OUT OF THE WOODS YET

Even if seeds and/or plants survive excess moisture conditions, the effects from those conditions could last after waters recede and soils dry up. One concern for plants that have yet to emerge is soil crusting which may result after the soil dries after a rain (especially those high in clay). The crust can physically impede growth of the emerging plant and therefore prevent emergence.

For emerged crops, excess moisture during the early vegetative stages can slow root development. As a result, plants may be subject to greater injury during a dry summer because root systems are not sufficiently developed to access available subsoil water. Lengthy periods of wet soil conditions can also favor the development of disease.