# Preventing and Eliminating Fusarium Head Blight and Other Fungal Diseases

by Will Feenstra, Soil and Plant Health Specialist, Agriculture Solutions, Inc.

The ***Fusarium graminearum*** fungus causes a devastating disease in wheat, barley, oats, rye, corn, triticale, canary seed and even some forage grasses.

The Fusarium fungus was identified over 100 years ago in 1884 in England and the disease it causes, Fusarium Head Blight (FHB), got its common name, Tombstone disease, because of the chalky, decrepit appearance of the kernels that are infected by it. Incidence of Fusarium infection increases in moist, warm conditions, during a plant's flowering stage and during early stages of kernel development. Fusarium infected kernels are typically shrivelled, white or pink in colour and light in weight and therefore, easily lost during combining or seed cleaning. In Barley, Fusarium mould appears as an orange or black encrustation on the seed surface and causes significant grade degradation.

## Why Worry About Fusarium?

Fusarium can have a large, negative impact on livestock and grain. Many Fusarium species (including *F. graminearum*) produce mycotoxins. A mycotoxin is a fungal chemicals that is harmful to animals and people. These chemicals may operate in nature to disable plant defense mechanisms or to defend the fungus against other microorganisms. The major toxin produced by *F. graminearum* in association with FHB in wheat and barley is deoxynivalenol (DON). DON is sometimes called vomitoxin because of its deleterious effects on the digestive system of swine and other monogastric animals. DON disrupts normal cell function by inhibiting protein synthesis. Humans consuming flour made from wheat contaminated with DON will often demonstrate symptoms of nausea, fever, headaches, and vomiting.

DON contamination is measured in parts per million (ppm). DON levels in FHB-infected wheat are frequently quite high (>20 ppm). It is recommended that DON levels in human foods not exceed 1 ppm. However, individual grain buyers may have lower tolerances of DON in purchased grain. There are various guideline levels of DON permissible in livestock feed: ruminant animals, such as feeder cattle, are the most tolerant, while swine have the highest sensitivity to DON in livestock feed, with pigs refusing feed containing 1 ppm of DON. Although animals do not die from ingesting DON infected grains, it can reduce the feed intake and cause significant production losses. Some studies have shown that beef cattle can handle up to 12 ppm DON and that Dairy cattle can handle 8 ppm DON without it affecting yields. The maximum DON level set by Agriculture and Agri-Food Canada is 1 ppm for swine, dairy cattle and horses, and 5 ppm for beef cattle, sheep and poultry. DON has also been shown to have many adverse effects on pregnant animals.

## Understanding the Fusarium Life Cycle.

*Fusarium graminearum* overwinters on infested crop residues such as corn stalks, wheat straw, and other host plants. It is spread by water splashing, by cultivation and planting equipment, and by infected seeds. Fusarium spores also get picked up by wind and can travel great distances. Fusarium spores enter the unsuspecting plant through wounds caused by hail, birds or insects, or can enter through the plant's roots, and travel through the root cortex and into the plant's water conducting tissue called the xylem.

Here, microconidia (asexual spores) are produced and travel upward through the plant's sap stream and germinate where the flow stops. Over time, the fungal spores clog the plant's vascular system, which prevents the plant from absorbing and translocating nutrients. As a result, the stomata close, the leaves wilt, and the plant eventually dies. After death, the fungus completely takes over, creating more spores to quickly infect surrounding susceptible plants.

## Identifying the Fusarium Head Blight (FHB)

Individual plants of cereal crops (e.g. wheat) produce multiple stems, and each stem produces a single seed spike which emerges at the end of the stem. The spike is composed of multiple spikelets positioned on alternate sides of the spike's stem. Each spikelet is composed of flowering structures where seed develops. The first symptoms of Fusarium head blight occur shortly after flowering. Diseased spikelets exhibit premature bleaching as the pathogen grows and spreads within the head. One or more spikelets located in the top, middle, or bottom of the head may be bleached.

Over time, the premature bleaching of the spikelets may progress throughout the entire head. If the environment is warm and moist, aggregations of light pink/ salmon colored spores (sporodochia) may appear on the rachis and glumes of individual spikelets. Later in the season, bluish- black spherical bodies may appear on the surface of affected spikelets. These bodies are sexual structures of the fungus known as perithecia, and can be seen readily in the lab.

As symptoms progress, the fungus colonizes the developing grain causing it to shrink and wrinkle inside the head. Often, the infected kernels have a rough, shriveled appearance, ranging in color from pink, soft-gray, to light-brown.

## Eliminating Fusarium from Your Soils.

A Fusarium infection that occurs one season can affect your crops and livestock the next season, too. Residues that lay in fields from cereal and corn crop production will provide a cozy overwintering home for the fungus allowing it to inoculate your new crops. Large populations of Fusarium fungi can hide out in corn stalks and other residues that are not properly broken down. This is why it is so crucial to promote the breakdown of Corn stalks and any other crop residues that remain after harvest. This can be done by spraying Agriculture Solutions MaxMix™ or TrueBlend™ Soil Rejuvenator which act as a catalyst for crop residue breakdown. It can also enhance soil nutrient digestion, help build soil tilth and increase organic matter which improves moisture holding capacity. It is interesting to note that studies have established a relationship between previous glyphosate use and increased Fusarium infection of spikes and subcrown internodes of wheat and barley, or in the Fusarium colonization in crop residues. Therefore, we could conclude that use of herbicides containing glyphosate causes elevated fusarium infection levels as well as the resulting yield loss.

## Preventing Fusarium from Attacking Your Crops.

Fusarium is attracted to plants that aren't producing complex carbohydrates. These are plants that lack the necessary nutrients to maximize photosynthesis that produces these sugars. Once a plant's primary functions are compromised, its immunity also becomes compromised, giving way to attack by Fusarium and other pathogenic fungus and bacteria. Supplying an adequate and balanced flow of available nutrients to your crops is the best way to avoid fungal attack. With the right nutrients, your crops will be able to maximize photosynthetic potential and be able to produce the carbohydrates such as pectins and polysaccharides that build resistance to these pathogens. Disease pathogens are naturally occurring and have a place in nature. They won't go away but they will stop attacking your crops if you make sure your crops have high immunity that comes with overall health. The over-application of nitrate nitrogen can have a negative impact on plant nutrient uptake and reduce overall plant health, therefore opening the plant up as a target to bacteria and fungus such as Fusarium Head Blight.

## Final Thoughts.

Fusarium Head Blight can cause reduction in yield and quality, as well as health issues in animals consuming feed that contains high DON levels. Undigested crop residues serve as an ideal place for Fusarium to survive over winter. The best defense against fungal diseases, such as Fusarium Head Blight, is a strong beneficial microbe community the can out-compete the fusarium and other fungal pathogens. Microbes thrive in soils with high organic matter and will digest infected crop residues and kill fungus.