agKnowledge Spotlight
Shedding light on the concerns of your fields.

Corn Plant Health Management to Help Maximize Yield Potential

- A uniform and vigorous corn stand is the first step in optimizing yield potential.
- Critical growth stages of corn include rapid vegetative growth, pollination, and grain fill.
- Stress during these critical growth stages can reduce the rate of photosynthesis, which can lead to yield reduction.
- Nutrient management and disease control can help reduce plant stress during critical growth stages.

Corn Yield Potential Component

The number of ears per acre, the number of kernels per ear, and the weight of each kernel determines corn yield potential. The interaction between factors such as corn product genetics, weather conditions, soil types, pest pressure, and available nutrients at specific times in the growing season can affect corn yield potential.

Critical Growth Stages

It is important to understand the critical growth stages of corn that help determine final yield potential. Establishing a good, uniform stand is the first step in optimizing yield potential in order to help maximize the number of ears per acre. The second critical growth stage occurs when kernel number is established, during the rapid stage of corn vegetative growth (V6 to V12), the number of kernels per ear is initiated. Stress-free corn plants during this time can help maximize the potential number of harvested kernels.[1]

The third critical growth stage occurs during the pollination process. Pollination is critical to converting potential kernel numbers into actual developing kernels. The success of pollination is greatly influenced by the weather. Drought stress can desiccate silks and pollen grains, which can result in barren ears and/or short ears with unfilled tips (Figure 1).

The final critical growth stage is the grain fill or kernel development period. This stage begins at pollination and ends at kernel black layer formation. Stress during this stage can reduce kernel number, size, and weight of harvested kernels.[1]

Photosynthesis and Yield Potential

During the grain fill stage, any stress on the photosynthesis process can reduce yield potential. Photosynthesis produces the energy (carbohydrates) that a corn plant needs to survive and produce grain. Drought, high temperatures, extended periods of cloudy weather, foliar diseases, hail damage, and nitrogen (N) deficiency can, individually or in combination, significantly reduce photosynthesis.[2]

Figure 1. Corn ears with unfilled tips.

After pollination, corn plants redirect carbohydrate movement to fill the developing kernels, while sacrificing the health of the stalk, leaves, and roots.[2] This process can physically weaken the plant, and make the plant more susceptible to stalk and root diseases. Fields at highest risk for stalk rot include those that have developed ears with high yield potential because of ideal conditions during vegetative growth, but experienced severe stress during the grain fill stage.

The effects of plant stress can be intensified by sandy soils that have minimal water-holding capacity or on plants that have a restricted root system due to compacted soils, nematode damage, or corn rootworm feeding.

Severe stress during the dough and dent stages of grain fill can lead to the premature formation of kernel black layer. This can reduce yield potential due to decreased kernel size and weight.[3] When the black layer forms, no additional nutrients can flow into the kernel and drydown begins.

Managing Stress Conditions

Although little can be done to control damage from plant stress during periods of hail, drought, and high temperatures, the following issues can be mitigated with proper management and treatment:

Fertility. Adequate fertility is essential to maintain late-season plant health. A common photosynthetic stress that can occur during late grain fill is N deficiency, which can cause the leaves to turn yellow and die. Saturated corn fields, due to wet conditions early in the season, may lead to a loss of N from denitrification and leaching. Losing leaves during grain fill can reduce the ability of the plant to produce photosynthate and also decrease the nutrients that can be remobilized to the ear.

Corn Plant Health Management to Help Maximize Yield Potential

Nitrogen should be applied according to crop need and should be applied two to three times per season, depending on growing conditions. Split applications can help reduce the chance of N loss through denitrification and leaching. Corn requires the most N during rapid vegetative growth, so applications of N should occur prior to this stage, or within the V5 to V8 growth stages.

Potassium (K) is a critical nutrient during pollination and grain fill. If K is limited, silk emergence may be delayed, possibly resulting in unfilled ear tips. Potassium is also essential for the plant to move energy from the leaves to filling grain. Low levels of K in combination with excessive N can also lead to higher levels of stalk rot. Apply K according to soil test results. Lower K values may occur in fields where crop residue is removed or in fields previously planted with a soybean crop, as soybean typically removes more K from the soil than corn.[4]

Leaf diseases. Fungal leaf diseases (Figure 2) can have a significant effect on corn yield potential through reduced photosynthetic capability, standability, and grain quality.

Since much of the energy from photosynthesis is produced by the leaves immediately surrounding the primary ear, it is important to protect those leaves from disease. Fungicide applications made prior to the spread of a disease throughout the canopy can help improve overall plant health and protect yield potential. While maximum yield potential is mostly determined before the tasseling growth stage (VT), kernel fill can be influenced considerably by protecting the crop from diseases.

Regular and timely scouting is important to help prevent corn disease outbreaks. Reduced and no-till practices can increase the incidence of disease as does continuous corn. Both scenarios increase the amount of corn residue left on the field, potentially accelerating the presence of disease inoculum.[5]

Figure 2. Cigar-shaped Northern corn leaf blight lesions (left) and typical rectangular-shaped lesions from grey leaf spot.

Disease Management

Disease incidence can vary greatly from season to season. The following practices can help reduce disease pressure in corn:

- Select corn products that have resistance to common disease problems in the local seedling diseases.
- Rotate to other crops and remove crop residue and weeds to reduce plant material that may be used to harbor populations of disease organisms.
- Apply fertilizer according to soil test recommendations to promote vigorous and healthy plant growth.
- Subsoil below the row to help lessen compaction that may impede root growth.
- Use fungicides when needed to help reduce potential losses.[6]
- Fungicide efficacy depends on accurate application rate, timing, and method as stated on the product label and disease presence in the field. Deciding to apply a fungicide should be based on scouting, environmental conditions, management practices, disease pressure, and potential growing area.

Use a premium seed treatment to reduce seed rots and economic advantage. Potential yield increase of the crop should cover the cost of the application.

Foliar fungicides are typically active for 14 to 21 days after application. An optimal application of a fungicide can protect leaves from foliar fungi during grain fill. When foliar diseases are controlled, corn also may be less susceptible to stalk rots.

Summary

Reducing stress on photosynthesis during critical growth stages can help maximize corn yield potential. Nutrient and disease management can help preserve yield potential and are critical in managing corn plant heath throughout the growing season.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development, & Agronomy by Monsanto.

Sources:

[1] eXtension. 2008. Corn yield potential. eXtension. http://www.extension.org/.
[2] Nielsen, R.L. 2011. Top leaf death or "dieback" in corn. Purdue University. http://www.agry.purdue.edu/.
[3] Nielsen, R.L. 2013. Effects of stress during grain filling in corn. Purdue University Extension. http://www.agry.purdue.edu/.
[4] Potash & Phosphate Institute. 1997. A balanced diet of nitrogen, phosphorous, and potassium is essential for the development of a corn plant. Agri-Briefs No. 4. https://www.ipni.net/.
[5] Wise, K. and Mueller, D. 2011. Are fungicides no longer just for fungi? An analysis of foliar fungicide use in corn. American Phytopathological Society. http://www.apsnet.org/.
[6] Kemerait, B. 2015. Corn disease and nematode management. The University of Georgia. A Guide to Corn Production in Georgia. CSS 01-2015. http://www.caes.uga.edu/.
Nielsen, R.L. 2013. Stress during grain fill: A harbinger of stalk health problems. Purdue University. http://www.agry.purdue.edu/. Barker, D. et al. 2005. Corn disease control. Ohio Agronomy Guide 14th Edition. Ohio State University Extension. http://agcrops.osu.edu/. Fernandez, F. 2009. Identifying nutrient deficiencies in corn. University of Illinois. http://bulletin.ipm.illinois.edu/. Web sources verified 05/26/15.