

Corn Response to High pH Soil Environments – NW KS, SW NE, NE CO

2021

Background and Rationale

- Soil pH is a measure of the relative acidity or alkalinity of the soil solution.
- Alkaline or high pH (>7) soils is mainly naturally occurring in this part of the country, NE CO, SW NE, NW KS
- High soil pH can limit the uptake of several nutrients, such as phosphorous, zinc, iron, manganese, boron, and copper. (Figure 1)
- Corn products can respond differently to high soil pH environments, as indicated from the presence of iron chlorosis (Figure 2)
- Response may not be the same when soil organic matter levels differ <1.5% or > 2.0%



Figure 1. Severe iron chlorosis in a corn hybrid in low organic matter soil.

Objectives

- Evaluate performance of Pioneer® brand corn products in high soil pH environments.
- Characterize corn product performance differences in calcareous soils with various organic matter levels.
- Provide better product placement recommendations for high soil pH fields.

Study Description

Trials were placed on soils with a historic high pH (>7.9) where iron chlorosis symptoms are likely to be observed. (Figure 3)

Soil samples were taken across high pH locations to determine actual pH as well as organic matter levels



Figure 2. Visual differences in early season chlorosis among Pioneer® brand corn products in high pH soil.

- Field observations were collected across 16 locations across northeast Colorado, southwest Nebraska, northwest Kansas over a four-year period.
- Observations were collected early in the season (V7-V8) as well as late in the season (R3-R4). Yields were collected in most of these locations
- Pioneer brand corn products were evaluated based on color (chlorosis) and yield.
- A three-bucket (ASC) rating system was used: S = Strength, A = Acceptable, and C = Consideration.
- Observations were combined, and a final rating was assigned to each hybrid for high pH in calcareous.

Results

- Pioneer® brand corn products responded differently to high pH calcareous soils with varying levels of organic matter.
- Some products showed visual symptoms (yellowing) associated with high pH soil but still maintained yield across the field.



Figure 3. Hybrid plot within a high pH area of the field

Table 1. Corn product suitability to calcareous high pH soil.

Hybrid/Brand ¹	Visual Crop Color	Overall Suitability
P9193Q™ (Q, LL, RR2)	A	A
P9489Q™ (Q, LL, RR2)	S	S
P9551Q™ (Q, LL, RR2)	A	A
P9880AMXT™ (AMXT, LL, RR2)	C	A
P9998Q™ (Q, LL, RR2)	A	S
P0046AM™ (AM, LL, RR2)	S	A
P0157 Family	A	A
P0075Q™ (Q, LL, RR2)	S	S
P0039Q™ (Q, LL, RR2)	A	A
P0343AML™ (AML, LL, RR2)	A	A
P0404Q™ (Q, LL, RR2)	C	A
P0487Q™ (Q, LL, RR2)	A	A
P0622Q™ (Q, LL, RR2)	A	A
P0817Q™ (Q, LL, RR2)	S	A
P0908AML™ (AML, LL, RR2)	A	A
P0924Q™ (Q, LL, RR2)	S	S
P0950Q™ (Q, LL, RR2)	A	A
P0995AM™ (AM, LL, RR2)	A	A
P1082AM™ (AM, LL, RR2)	A	A
P1089AMXT™ (AMXT, LL, RR2)	A	A
P1237AM™ (AM, LL, RR2)	A	A
P1244Q™ (Q, LL, RR2)	S	A
P1278Q™ (Q, LL, RR2)	S	S
P1353Q™ (Q, LL, RR2)	A	A
P1366Q™ (Q, LL, RR2)	A	S
P1548AM™ (AM, LL, RR2)	A	A
P1563Q™ (Q, LL, RR2)	A	A
P1572AM™ (AM, LL, RR2)	A	A
P1716Q™ (Q, LL, RR2)	A	A
P1828Q™ (Q, LL, RR2)	S	A
P1847AML™ (AML, LL, RR2)	A	A
P2042AML™ (AML, LL, RR2)	A	A

Legend: S=Strength, A=Acceptable, C=Consideration

Conclusions and Management Considerations

- Management practices for high pH soils include:
 - Aggressive utilization of starter fertilizer.
 - Manure application to areas with known micronutrient issues.
 - Limit early water applications, if possible, to keep soils from sealing over.

- Performance ratings of Pioneer brand products in calcareous high pH soils based on results of this study are shown in Table 1.

- S = Strength – tolerates the condition better than other Pioneer brand products observed in the same environment.
- A = Acceptable – has an average tolerance to the condition relative to other Pioneer brand products observed in the same environment.
- C = Consideration – the hybrid is less tolerant of the environment relative to other Pioneer brand products observed. Consider another product choice.

- Corn product selection:

- Select corn products that show optimum yield performance.
- Select corn products that can maintain acceptable plant and ear height.
- Select corn products that can tolerate elevated soil pH levels.
- Visit with your local Pioneer sales representative or dealer for information on Pioneer brand corn product options.

Reference

Lutt, N., D. Berning, and S. Endicott. 2016. Corn Management in High pH Soils. Pioneer Field Facts Vol. 16 No. 14.



AMXT - Optimum® AcreMax® XTreme contains a single-bag integrated refuge solution for above- and below-ground insects. The major component contains the Agrisure® RW trait, the YieldGard® Corn Borer gene, and the Herculex® XTRA genes. In EPA-designated cotton growing counties, a 20% separate corn borer refuge must be planted with Optimum AcreMax XTreme products. **AMX** - Optimum® AcreMax® Xtra Insect Protection system with YGCB, HXX, LL, RR2. Contains a single-bag integrated refuge solution for above- and below-ground insects. In EPA-designated cotton growing counties, a 20% separate corn borer refuge must be planted with Optimum AcreMax Xtra products. **AM** - Optimum® AcreMax® Insect Protection system with YGCB, HX1, LL, RR2. Contains a single-bag integrated refuge solution for above-ground insects. In EPA-designated cotton growing counties, a 20% separate corn borer refuge must be planted with Optimum AcreMax products. **YGCB** - The YieldGard® Corn Borer gene offers a high level of resistance to European corn borer, southwestern corn borer and southern cornstalk borer; moderate resistance to corn earworm and common stalk borer; and above average resistance to fall armyworm. **HXX** - Herculex® XTRA contains the Herculex I and Herculex RW genes. **HX1** - Contains the Herculex® I Insect Protection gene which provides protection against European corn borer, southwestern corn borer, black cutworm, fall armyworm, western bean cutworm, lesser corn stalk borer, southern corn stalk borer, and sugarcane borer, and suppresses corn earworm. **LL** - Contains the LibertyLink® gene for resistance to Liberty® herbicide. **RR2** - Contains the Roundup Ready® Corn 2 trait that provides crop safety for over-the-top applications of labeled glyphosate herbicides when applied according to label directions. YieldGard®, the YieldGard Corn Borer design and Roundup Ready® are registered trademarks used under license from Monsanto Company. Liberty®, LibertyLink® and the Water Droplet Design are registered trademarks of Bayer. Herculex® Insect Protection technology by Dow AgroSciences and Pioneer Hi-Bred. Herculex® and the HX logo are registered trademarks of Dow AgroSciences LLC. Agrisure® is a registered trademark of, and used under license from, a Syngenta Group Company. Agrisure® technology incorporated into these seeds is commercialized under a license from Syngenta Crop Protection AG.

Authors: Mike Kriegshauser, Aaron Vammer, Dalton Kampsen, Chris Weber, Cody Sullivan

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¹ All Pioneer products are hybrids unless designated with AM1, AM, AML, AMXT, and Q in which case they are brands.

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