Non-ionic surfactants and arrested ear development in corn

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Introduction

A common disorder that can cause a reduction in corn yields is known as arrested ear development. Arrested ear development is not a disease; however, it can be caused by applying nonionic surfactants (NIS) before tasseling in corn (1). Nonionic surfactants are used to reduce the surface tension between the leaf surface and water droplet allowing the droplet to spread and cover more area on the leaf. This can mean better penetration of pesticides on the leaf. The growth stages that are most at risk for arrested ear development are when twelve to fourteen leaf collars are exposed (V12 to V14).

Arrested ear development can also depend on the corn hybrid and environment. Symptoms are seen on the ears, husks, leaves, and silks of the corn plant twenty-eight days after foliar applications of NIS. Symptoms result in shorter ears, fewer kernels, and dried ear tips (Fig. 1,2). Husks will have a hollow feel when squeezed and have a slender look following pollination (Fig. 2). Fewer silks on the ear is due to the underdevelopment of the kernels in the plant. Leaves will show discoloration when the corn ear is severely affected (Fig. 3)

Although NIS has been linked to arrested ear development for years, damage is inconsistent and questions still remain on what products are more likely to cause arrested ear development.

Figure 1. Comparison of a normal ear (left) and ears with arrested ear development (right).

Figure 2. Husk and silk symptoms of arrested ear development on the left ear and normal ear development on the right.

Figure 3. Purple discoloration in a plant severely affected by arrested ear development.

Objective

The objective of this research is to determine the effects of nonionic surfactant products on arrested ear development.

Materials and Methods

Experimental Design

- The arrested ear development research trial was established in Princeton, KY at the University of Kentucky Research and Education center in the summer of 2018.
- Treatments were sprayed in a randomized complete block design with four replications.
- The corn hybrid AG6499 was planted in 30-inch row spacings at 32,000 seeds/A on May 9, 2018
- NIS was sprayed at V14 on June 29, 2018, at the recommended rates.
- The nonionic surfactants were sprayed using a CO_2 pressurized backpack sprayer and a backpack boom with TJ-8002 flat fan nozzles spaced at 20 inches.
- Boom pressure was regulated at 41 psi which delivered 20 gal/A while traveling at 3 mph.
- There are four nonionic surfactants used in this research. Products were sprayed at recommended rates. A non-treated control was included.
  - **Preference®** (Alkylphenol ethoxylate, sodium salts of soya fatty acids, isopropyl alcohol)
    > Sprayed at a rate of 2.5 fl oz/A
  - **Class Act®** (Ammonium sulfate, corn syrup, alkyl polyglucoside)
    > Sprayed at a rate of 2.5 fl oz/A
  - **Interlock®** (Modified vegetable oil, polyoxyethylene sorbitan fatty acid ester, vegetable oil)
    > Sprayed at a rate of 2 fl oz/A
  - **Masterlock®** (Modified vegetable oil, polyoxyethylene sorbitan fatty acid ester, vegetable oil, soybean oil, ethoxylated)
    > Sprayed at a rate of 6.4 fl oz/A

Data Collection

- Weekly observation of the ears for visual differences prior to four week rating.
- Sampled 10 ears/plot four weeks after application.
- Measured ear length.
- Rated damage (% severity) in relation to non-treated control.
- Analyzed data using SAS v.9.3.

Results

- Treatment did not have a significant effect on ear length at the P = 0.05 level (Table 1)

Table 1. Effect of non-ionic surfactant on ear length. Values followed by the same letter are not different at the P = 0.05 level.

Treatment	Trade name	Ear length
Non-treated		20.61 A
Alkylphenol ethoxylate, sodium salts of soya fatty acids, isopropyl alcohol	Preference	21.24 A
Ammonium sulfate, corn syrup, alkyl polyglucoside	Class Act	21.16 A
Modified vegetable oil, polyoxyethylene sorbitan fatty acid ester, vegetable oil)	Interlock	21.16 A
Modified vegetable oil, polyoxyethylene sorbitan fatty acid ester, vegetable oil, soybean oil, ethoxylated	Masterlock	20.96 A

- Several factors could have affected why damage was not seen.
  - Hybrid sensitivity to NIS
  - Temperature at time of application
  - Were ears collected too early?
  - Are these products different than products used in earlier studies?
  - Was the timing of application too late to see damage?

Conclusion

There may be opportunities to use NIS pre-tassel in the future. However, more research is needed to know when and where to spray NIS.

Acknowledgements and References

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2) Stetzel, N., Wise, K., Nielsen, B., & Gerber, C. (2011). Arrested Ear Development in Hybrid Corn. *Purdue Extension*, 1-3.