

ADVANCEMENTS IN CLEARFIELD® PLUS SUNFLOWER HYBRID VARIETY DEVELOPMENT

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ABSTRACT

Clearfield® Plus sunflowers, the next generation herbicide tolerance trait based on a single mutation in the acetohydroxyacid synthase gene, *Ahas1-3*, or *CLHA-Plus*, was first launched in Argentina in 2010. Since then, Clearfield Plus hybrids have been introduced to the market in the USA, Romania, Bulgaria, and South Africa with additional countries anticipated in 2016. To speed the introduction of Clearfield Plus hybrids to the market, first generation hybrids combine the *CLHA-Plus* mutation, homozygous, on one parent with the *Ahas1-2* (*ImiSun*) mutation, homozygous, on the second parent (hetero combo). In this manner breeding companies optimize resources and inbreds from existing Clearfield breeding programs in combination with converted or new *CLHA-Plus* inbreds. Clearfield breeding programs, though, have been hampered by the necessity to spray select tolerant individuals containing both the *ImiSun* mutation plus enhancing (E)-factor(s), required for full commercial tolerance. To date, no reliable molecular markers have been developed to detect the presence and zygosity of the E-factor(s), making marker assisted selection unfeasible. This paper investigates the learnings from the past 5 years comparing Clearfield and Clearfield Plus hybrid systems both from the breeding perspective and from the grower perspective. The next generation Clearfield Plus hybrids coming to the market include *CLHA-Plus* (*Ahas1-3/Ahas1-3*) homozygous hybrids which benefit from more efficient breeding improvements and, like their hetero combo counterparts, demonstrate improved herbicide tolerance leading to more reliable tolerance in diverse environments. All Clearfield Plus hybrids benefit from improved herbicide products and increased weed control spectrum in South America as well as in Europe and Eastern Europe.

Key Words : Clearfield, Clearfield Plus, breeding, E factor, *CLHA-Plus*