



GLOSSARY

VB – The initials VB refer to varietal blend, and appear after the varietal names AC® Unity, AC® Goodeve, AC® Glencross, AC® Fieldstar and future varieties to be released.

Refuge – Refuge refers to the 10% susceptible variety in the blend (90% tolerant, 10% susceptible). In the case of AC® Unity VB, the refuge variety is AC® Waskada, for AC® Goodeve VB, the refuge variety is AC Intrepid, for AC® Glencross VB, the refuge is AC® Burnside and for AC® Fieldstar VB, the refuge is AC® Waskada.

The objective of the interspersed refuge is to prevent the build up of the virulent midge population. The non-virulent midge will survive on the 10% susceptible plants and inter-mate with virulent midge. The progeny of this cross will be non-virulent since this is usually a dominant gene.

Interspersed – Interspersed means that the refuge variety (AC® Waskada, AC Intrepid or AC® Burnside) is evenly distributed (inter-seeded) throughout the field. This is different to the *Bt* corn refuge management system where the refuge (susceptible variety) is grown as a block beside or within the same field.

Sm1 – The *Sm1* is a single gene that is responsible for midge tolerance. Midge tolerance was put into AC® Unity, AC® Goodeve, AC® Glencross and AC® Fieldstar using traditional plant breeding techniques, not biotechnology.

When the insect begins to feed on the seed, the *Sm1* gene causes the level of phenolic compounds to elevate more rapidly than in wheat kernels without the *Sm1* gene. The higher levels of phenolic acids cause the midge larvae to stop feeding and the larvae starve to death.

Wheat varieties with the *Sm1* gene show significantly less damage from wheat midge larvae and consistently grade better under midge infestations than susceptible varieties. The *Sm1* gene is the only known source of genetic resistance to wheat midge.

Non-virulent – Non-virulent wheat midge cannot survive the *Sm1* gene contained in midge tolerant wheat. When non-virulent midge feed on the midge tolerant wheat, the seed starts producing higher levels of phenolic acids. The increased levels of phenolic acids cause the larvae to stop feeding and as a result the larvae starve and die.



Virulent – Virulent wheat midge are resistant to the effects of the *Sm1* gene. They carry a mutation that allows them to attack wheat plants with the *Sm1* gene and survive. A very low level of virulent midge exists within the natural midge population.

Phenolic Compounds – Phenolic compounds are naturally occurring organic acids in wheat kernels. Midge tolerant wheat is able to produce phenolic acids within the first few days after anthesis and at higher levels than midge susceptible varieties. Phenolic acids stop the wheat midge larvae from feeding and the larvae starve to death.

The mechanism that triggers the production of phenolic acids does not operate if midge larvae are not feeding on the seed, and in addition, these acids are reduced to normal levels by the time wheat reaches maturity – thus not affecting the quality or food value of the harvested grain.

Single Gene Resistance – Single gene insect resistance, for example *Sm1*, is likely based on a gene-for-gene relationship between the host and pest. This type of resistance has a history of becoming ineffective over time as insect populations change. Without an interspersed refuge, only the virulent midge biotype survive, mate with other virulent midge, and quickly build up a large population that can feed on wheat varieties containing the *Sm1* gene.

For example, Hessian fly resistance genes in spring wheat in the U.S. are deployed without a refuge. These genes were quickly overcome due to shifts in the Hessian fly population.