# *Sm1* (midge tolerance) Detected in Most SWS Wheat

**Background:**

*Sm1*, the only known gene that confers tolerance to wheat midge, was first identified in soft red winter wheat varieties. In the late 1990s, Canadian public breeders worked to cross this naturally occurring trait into red spring wheat (CWRS and Extra Strong) for the benefit of western Canadian producers. These first products were launched in spring 2010 (AC® Unity VB, AC® Goodeve VB, AC® Glencross VB). Since that time, over 20 varieties of Midge Tolerant Wheat have been registered in many classes, including CWRS, CPSR, CWES, CWAD, and GP/SP.

As *Sm1* products neared commercialization, entomologists agreed that the risk of midge becoming resistant to the trait was highly likely. They suggested a stewardship plan incorporating an interspersed refuge (10% of a susceptible variety) was necessary to preserve the useful life of the *Sm1* trait.

First evidence of *Sm1* in soft white spring (SWS) wheat varieties came from field tests from the General Purpose Coop during the 2015 growing season – conducted by the Agriculture & Agri-Food Canada (AAFC) Manitoba wheat midge program (Curt McCartney and Sheila Wolfe) and the University of Manitoba midge program (Alejandro Costamagna, Ian Wise, and Roxanne Georgison). These varieties were identified as midge resistant based upon dissection of wheat spikes.

In 2016, in coordination with SWS Breeder Dr. Harpinder Randhawa, the entire SWS Coop was tested. The data was all based on dissection of spike samples from the Coop field tests.

Also in 2016, Dr. Curtis Pozniak from the Crop Development Centre (CDC) at the University of Saskatchewan, tested a marker for *Sm1* on Wheat Coop entries. This was done to see if his DNA marker accurately predicted the field-based phenotype (i.e. kernel damage). The DNA marker developed by CDC was done in conjunction with researchers at AAFC. To date, the marker results appear to match the results from the spike dissections.

Based on the work above, the following varieties carry *Sm1* and are midge tolerant:

AAC Awesome (CWSP), AAC Chiffon, AAC Indus, and AC® Sadash.
AAC Paramount is suspected to carry *Sm1* but needs to be confirmed by field test in 2017.

AC Andrew has been tested by marker and in the field, and **does not contain** *Sm1* – for this reason it will be an appropriate refuge for all tolerant varieties.

**Why Stewardship Now?**

If *Sm1* varieties have been grown in other regions without a refuge, why do we need a refuge in Western Canada? Other regions (like the UK and Eastern USA) do not have a large acreage of wheat in rotation. In Western Canada, the traditional fit for SWS wheat was the irrigation area of Southern Alberta – this area typically has little to no midge pressure. However, in the last 7-8 years, we have seen growth in soft white acres into non-traditional areas to supply the feed and ethanol market. In comparison to other classes, the SWS acres are relatively small. This is fortunate, but still needs to be addressed.

The fact we have been growing SWS without a refuge puts the *Sm1* trait at risk. Midge Tolerant Wheat saves producers $40-60 million per year ($36 per acre). There are no replacement tolerance genes. “There is No Plan B.”

For this reason we need to act as quickly as possible to put a stewardship plan in place for the benefit of all wheat producers (not just soft white).

**The Stewardship Plan:**

Seed growers will add refuge to all future seed stocks released of AAC Awesome, AAC Paramount (once field results confirm resistance), AAC Indus, AAC Chiffon and AC® Sadash.

Varieties that have not yet been released have limited volumes. Remediation will be a much greater challenge for a variety like AC® Sadash that is currently grown on several hundred thousand acres, making up over half of the total SWS acres.

For AC® Sadash there were two options to protect *Sm1*:

1) Work with SeCan members and the industry to add refuge to all seed stocks available – as soon as realistically possible.

2) Deregister AC® Sadash to remove it from the system, and replace it with the new products that have refuge blended in.

SeCan has decided it is in the best interests of the industry that AC® Sadash remain available – and trust the industry will be willing to participate in implementing a stewardship plan.

The hope is that growers will "do what is right" to protect the trait for the benefit of future generations of wheat producers.

**How Can You Prevent Creating Resistance?**

- If you grow one of these SWS varieties, **add a refuge** – 1 bushel of AC Andrew to every 9 bushels of tolerant SWS variety.
- If you're unable to add the refuge, **spray insecticide** to eliminate the possibility of resistant midge (until you are able to add refuge).

In the near future, we hope to have the *Sm1* marker commercially available – this will give us the opportunity to monitor farm level samples of AC® Sadash for the appropriate level of refuge – to ensure the stewardship is being followed.