

## VARIETY RELEASES TARGETING WHEAT STEM SAWFLY PROPOSED STANDARD TERMINOLOGY

Background: Long-standing problems with heavy wheat stem sawfly losses have resulted in considerable research in developing varieties that show a measure of resistance to this pest. However, there is no specific terminology or criteria that are actually used to support claims regarding varying levels of vulnerability. It is inadequate to simply look at relative levels of sawfly-caused stem cutting, because other mitigating factors such as parasitic wasps or disease outbreaks can also decrease stem cutting.

At this time there are two entomologically known mechanisms of host plant resistance to wheat stem sawfly. These are antibiosis by stem solidness, and relative resistance by non-preference.

There is no evidence for terms like unattractive or tolerant, which mean something very different

Both antibiosis and resistance need to be corroborated by appropriate scientific data at the time that a variety release is proposed and sawfly resistance is claimed. Suggestions:

- 1) Stem solidness that decreases lodging via antibiosis. Larvae die predominantly as neonates and also during stem ripening, when tunneling by large larvae is impaired by dry pith. It is clear that the amount of pith plays a key role in the degree of antibiosis.
  - a) Therefore, it is proposed that stem solidness ratings (on the 5-25 scale) collected for at least **two years** and **three sites** should be used to establish a reliable measure of this parameter. The actual score should be given with the variety at the time of release.

Moreover, if the aggregate solidness rating **is less than 18**, it should be specifically stated that this level of stem solidness is unlikely to confer reliable resistance to sawfly stem cutting.

- b) Under **“heavier”** sawfly pressure, it is also proposed that sawfly infestation levels should be examined in association with stem cutting by dissecting 3 randomly collected 6-inch row samples containing these uncut stems from experimental plots at harvest. This will provide a useful measure of antibiosis – the percentage of infested, uncut stems with dead larvae.
- 2) Resistance by non-preference. In this case, a variety will receive fewer eggs which will result in reduced cutting in small plot experiments. This could occur for both solid and hollow stem varieties.
  - a) Under **“heavier”** sawfly pressure, it is proposed that sawfly infestation levels should be examined in association with stem cutting by dissecting 3 randomly collected 6-inch row samples containing these uncut stems from experimental plots at harvest. This will provide a measure of non-preference – the relative percentage of uninfested stems, which will be compared to the percentage of uninfested stems for a known attractive variety, also using 3 randomly collected 6-inch row samples containing these uncut stems

from experimental plots at harvest. **The percentage of uninfested stems in the “attractive” variety Reeder is suggested to be used as a continuous comparison, and could be planted as a permanent standard. It is also suggested that the variety Conan be planted as a permanent standard for an unattractive variety.**

Example: The unit used will be (percentage of uninfested stems in Reeder/percentage of uninfested stems in the new variety). Example: (10% uninfested Reeder / 60% uninfested new variety = 17% relative infestation). It is proposed that relative infestation data collected from at least **two years** and **three sites** should be used to establish a reliable measure of this parameter.

b) *For discussion.*

\*It is also possible that the levels of the **“known attractant compounds”** for female sawflies should also be measured at stem elongation in the laboratory to confirm the mode of resistance before this claim can be made at the time of variety release.

The measurements can be assessed relative to the known amounts for **“heavily-infested”** cultivars that produce large quantities of attractants and also relative to the known amounts for **“less infested”** cultivars that produce small quantities of attractants. It is proposed that volatile levels for Reeder (**“large amounts; heavily infested”**) and Conan (**“small amounts; less infestation”**) be used as the standards.

**Note: At this time, only relative non-preference has been demonstrated. Therefore, this parameter will only be of practical value when companion planted with an attractive variety.**

Terminology to be used at the time of proposed variety release:

- 1) “... has a mean stem solidness score of 22. Percentage of uncut, infested stems is 42%.” **Statement for release. ‘Stem solidness should significantly reduce sawfly cutting in most years.’**
- 2) “... has a mean stem solidness score of 11.6. Percentage of uncut, infested stems is 13%.” **Statement for release. ‘Stem solidness inadequate to reduce sawfly cutting.’** This should always be stated for every hollow stem variety.
- 3) “... has a mean stem solidness score of 14. \*Low levels of attractant compounds. Relative infestation was 22%.” **Statement for release. ‘Stem solidness inadequate to reduce sawfly cutting. Low levels of attractant compounds may reduce overall lodging when companion planted with an attractive variety.’**
- 4) “... has a mean stem solidness score of 21. Percentage of uncut, infested stems is 47%. \*Low levels of attractant compounds. Relative infestation was 27%.” **Statement for release. ‘Stem solidness should significantly reduce sawfly cutting most years. In**

**addition, low levels of attractant compounds may further reduce overall lodging when companion planted with an attractive variety.'**

Establishing these standards represents a considerable effort, but should only be necessary for promising varieties that demonstrate reduced sawfly cutting and are targeted for release as sawfly resistant.

### **Definitions:**

**These terms are all predicated on establishing two varieties to be grown as continuous standards for this terminology. These are Reeder as a positive control and Conan as a negative.**

**“Heavily-infested” or “heavy sawfly pressure” – Mean infestation in Reeder is 50% or greater. Infestation is determined only by stem dissection to eliminate confounding factors such as parasitoids or disease. This is different than using sawfly cutting as a standard.**

**“Attractants” – (*Z*)-3-hexenyl acetate, (*E*)- $\beta$ -ocimene, (*Z*)-3-hexenol – measured relative to ‘Reeder’ and ‘Conan’ at Zadoks 39 in replicated greenhouse experiments. The test variety and the two standards must be evaluated together. Less attractive would have attractant levels at 50% or less than Reeder and should be comparable to Conan or better.**

**“Highly attractive; heavily infested versus less attractive; less infested” – use Reeder and Conan as standards – as above. Typically, field infestation data will correlate with lower levels of attractants.**