

## Technical Working Party for Vegetables

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**MALE STERILITY IN CAULIFLOWER (TG/45/7)**

*Document prepared by an expert from Germany*

*Disclaimer: this document does not represent UPOV policies or guidance*

*Comments on the characteristic Male sterility in document TG/45/7 Cauliflower and its revision as proposed for adoption by the Technical Committee as presented in document TC/59/13 "Partial revision of the Test Guidelines for Cauliflower"*

1. The following observations were made on the states of expression of male sterility (Characteristic 28) and the explanation provided in chapter 8.2, as provided in the Annex to this document.

Observations on the scale

2. The states of expression are described as follows:

*Absent: >70% of the plants fertile (open-pollinated varieties or hybrid varieties produced with self-incompatibility system)*

*Partial: 30% to 70% of the plants fertile (hybrid varieties produced with genic male sterility, in heterozygous state)*

*Total: < 30% of the plants fertile (hybrid varieties produced with cytoplasmic male sterility)*

3. It has to be questioned whether it is appropriate to link states of expression to specific variety types. In general, it is incompatible with the phenotypic approach of UPOV guidance. It should also be noted that the examples in brackets do not cover all possible types of varieties, e.g. male sterile lines, male fertile inbred lines or restored CMS hybrids could be applied for protection as well. In addition, information on the hybrid formula and details on the genetic system used for the production of hybrids is not requested in the Technical Questionnaire (TQ) so far and parental lines are not included in the DUS test of hybrid varieties.

4. The scale indicates that it would be a QN characteristic (state 1 >70 %, state 2 from 30 % to 70%, state 3 < 30 %). Consequently, varieties with note 2 could not be considered to be clearly distinct from varieties with state 1 and 3. It should be considered whether the states are appropriate or not. Without GMS or CMS, it can be expected that a variety is 100 % fertile. In a functioning CMS system, without pollination by a restorer line, a CMS line or CMS hybrid would be expected to be 100 % male sterile, probably even within the limits of the same population standard as the other characteristics. In case of a segregating GMS hybrid, a 1:1 segregation could be expected.

5. The description of a variety with "Male sterility: partial" can be misleading. In general, the description refers to all individual plants of a variety (within the uniformity limits). "Partial male sterility" could be understood as "reduced male fertility" of all plants. In case of a GMS hybrid produced with a heterozygous mother, hybrids will segregate for male sterility into two distinct classes absent/present.

6. Segregating characteristics are also known in other crops with three-way hybrids, e.g. maize. In maize, segregating characteristics are indicated in the variety description with the different states of expression and the frequencies where appropriate or just with the note "segregating". According to document TG/1/3, segregation is not considered in the scale itself. Such approach should also be applicable for male sterility in cauliflower. Accordingly, the scale could be reduced to (1) absent, (9) present.

7. The explanation on the genetic background of GMS provided in document TC/59/13 Ad. 28 should be deleted. It is not clear that in case of recessive monogenic male sterility the heterozygous genotype would be male sterile. The genetic background is redundant for describing the expression of male sterility.

#### Observations on the use of the marker

8. According to the explanation provided in document TC/59/13 Ad. 28, the DNA marker test can be used for varieties declared male fertile (state 1) or total male sterile (state 3). This approach does not consider that, if the marker is linked to CMS, the marker would not allow to distinguish male fertile varieties (state 1) and segregating varieties (state 2), i.e. wrong declaration cannot be detected with the marker.

9. In addition, it should be noted that characteristic 28 and questions on the hybrid system are not included in the TQ so far.

10. If characteristic 28 would be taken up in the TQ and, in addition, information on the hybrid system would be requested in the TQ, the possibility to use the DNA marker for CMS could be linked to CMS according to the declaration in the TQ.

11. The importance of different hybrid systems (CMS, GMS), including potential different sources for CMS, and variety types in cauliflower have to be taken into account. The use of the described DNA marker must not lead to any unequal advantage for individual breeders in the DUS test including time and cost.

#### Other remark

12. The TWV might also reconsider the use of and guidance on male sterility characteristics in other *Brassica* species.

[Annex follows]

ANNEX

EXTRACT OF DOCUMENT TC/59/13 "PARTIAL REVISION OF THE TEST GUIDELINES FOR CAULIFLOWER"

Ad. 28: Male sterility

To be tested in a field trial and/or in a DNA marker test<sup>1</sup>.

In the case of a field trial, the type of observation is VS. In the case of a DNA marker test, the type of observation is MS.

Field trial:

- Absent: >70% of the plants fertile (open-pollinated varieties or hybrid varieties produced with self-incompatibility system)
- Partial: 30% to 70% of the plants fertile (hybrid varieties produced with genic male sterility, in heterozygous state)
- Total: < 30% of the plants fertile (hybrid varieties produced with cytoplasmic male sterility)



male fertile (pollen present)



male sterile (pollen absent)

DNA marker test and/or field trial:

Varieties declared male fertile (state 1) or total male sterile (state 3) in the TQ, can be examined in a field trial or in a DNA marker test.

Varieties with partial male sterility (state 2) and vegetatively propagated, total male sterile lines (state 3) cannot be examined in a DNA marker test but must be observed in a field trial.

It should be noted that lines exist which are male sterile due to the homozygous recessive monogenic male sterility (GMS) gene. These lines are used for the production of hybrids which then will be male fertile. However when a heterozygous mother line is used, the produced hybrids will be partially male sterile (state 2). Due to their nature these lines have to be propagated vegetatively. They are male sterile but do not have the DNA marker for the presence of CMS male sterility. So vegetatively propagated male sterile lines cannot be examined in a DNA marker test but must be observed in a field trial.

For the cases where only a DNA marker test is allowed (state 1 and state 3 seed propagated varieties), if the CMS marker appears to be not present, the variety is expected to have male fertile flowers. In cases where the CMS marker is present, the variety is expected to have male sterile flowers. All varieties declared partially sterile (state 2) and vegetatively propagated lines declared total male sterile (state 3) should be tested in a field trial.

In case the DNA marker test result does not confirm the declaration in the TQ, a field trial should be performed to observe whether the variety has male fertile or male sterile flowers or is segregating due to another mechanism.

The marker can be performed in multiplex with the markers for flower color (Ad. 25).

[End of Annex and of document]

<sup>1</sup> The description of the method to test male sterility for *Brassica* (CMS marker) is covered by a trade secret. The owner of the trade secret, Syngenta Seeds B.V., has given its consent for the use of the CMS marker solely for the purposes of examination of Distinctness, Uniformity and Stability (DUS) and for the development of variety descriptions by UPOV and authorities of UPOV members. Syngenta Seeds B.V. declares that neither UPOV, nor authorities of UPOV members that use the CMS marker for the above purposes will be held accountable for possible (mis)use of the CMS marker by third parties. Please contact Naktuinbouw, Netherlands, to obtain the method and information on the CMS marker for the purposes mentioned above.