



## **PROTOCOL FOR TESTS ON DISTINCTNESS, UNIFORMITY AND STABILITY**

### **SORGHUM**

***Sorghum bicolor* (L.) Moench.**  
***Sorghum ×drummondii* (Steud.) Millsp. & Chase**

UPOV Code: SRGHM\_BIC; SRGHM\_DRU

**Adopted on 19/03/2019**

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## **1. SUBJECT OF THE PROTOCOL AND REPORTING**

### **1.1 Scope of the technical protocol**

This Technical Protocol applies to all varieties of *Sorghum bicolor* (L.) Moench and *Sorghum xdrummondii* (Steud.) Millsp. & Chase.

The protocol describes the technical procedures to be followed in order to meet the requirements of Council Regulation 2100/94 on Community Plant Variety Rights. The technical procedures have been agreed by the Administrative Council and are based on documents agreed by the International Union for the Protection of New Varieties of Plants (UPOV), such as the General Introduction to DUS (UPOV Document TG/1/3 [http://www.upov.int/export/sites/upov/resource/en/tg\\_1\\_3.pdf](http://www.upov.int/export/sites/upov/resource/en/tg_1_3.pdf)), its associated TGP documents (<http://www.upov.int/tgp/en/>) and the relevant UPOV Test Guideline TG/122/4 dated 25/03/2015 (<http://www.upov.int/edocs/tgdocs/en/tg122.pdf>) for the conduct of tests for Distinctness, Uniformity and Stability.

### **1.2 Entry into Force**

The present protocol enters into force on **01.01.2019**. Any ongoing DUS examination of candidate varieties started before the aforesaid date will not be affected by the approval of the Technical Protocol. Technical examinations of candidate varieties are carried out according to the TP in force when the DUS test starts. The starting date of a DUS examination is considered to be the due date for submitting of plant material for the first test period.

In cases where the Office requests to take-over a DUS report for which the technical examination has either been finalized or which is in the process to be carried out at the moment of this request, such report can only be accepted if the technical examination has been carried out according to the CPVO TP which was in force at the moment when the technical examination started.

### **1.3 Reporting between Examination Office and CPVO and Liaison with Applicant**

#### **1.3.1 Reporting between Examination Office and CPVO**

The Examination Office shall deliver to the CPVO a preliminary report ("the preliminary report") no later than two weeks after the date of the request for technical examination by the CPVO.

The Examination Office shall also deliver to the CPVO a report relating to each growing period ("the interim report") and, when the Examination Office considers the results of the technical examination to be adequate to evaluate the variety or the CPVO so requests, a report relating to the examination ("the final report").

The final report shall state the opinion of the Examination Office on the distinctness, uniformity and stability of the variety. Where it considers those criteria to be satisfied, or where the CPVO so requests, a description of the variety shall be added to the report. If a report is negative the Examination Office shall set out the detailed reasons for its findings.

The interim and the final reports shall be delivered to the CPVO as soon as possible and no later than on the deadlines as laid down in the designation agreement.

#### **1.3.2 Informing on problems in the DUS test**

If problems arise during the course of the test the CPVO should be informed immediately so that the information can be passed on to the applicant. Subject to prior permanent agreement, the applicant may be directly informed at the same time as the CPVO particularly if a visit to the trial is advisable.

#### **1.3.3 Sample keeping in case of problems**

If the technical examination has resulted in a negative report, the CPVO shall inform the Examination Office as soon as possible in case that a representative sample of any relevant testing material shall be kept.

## **2. MATERIAL REQUIRED**

### **2.1 Plant material requirements**

Information with respect to the agreed closing dates and submission requirements of plant material for the technical examination of varieties can be found on <http://cpvo.europa.eu/applications-and-examinations/technical-examinations/submission-of-plant-material-s2-publication> in the special issue S2 of the Official Gazette of the Office. General requirements on submission of samples are also to be found following the same link.

## **2.2 Informing the applicant of plant material requirements**

The CPVO informs the applicant that

- He is responsible for ensuring compliance with any customs and plant health requirements.
- The plant material supplied should be visibly healthy, not lacking in vigour, nor affected by any important pest or disease.
- The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If it has been treated, full details of the treatment must be given.

## **2.3 Informing about problems on the submission of material**

The Examination Office shall report to the CPVO immediately in cases where the test material of the candidate variety has not arrived in time or in cases where the material submitted does not fulfil the conditions laid down in the request for material issued by the CPVO.

In cases where the examination office encounters difficulties to obtain plant material of reference varieties the CPVO should be informed.

## **3. METHOD OF EXAMINATION**

### **3.1 Number of growing cycles**

The minimum duration of tests should normally be two independent growing cycles.

### **3.2 Testing Place**

Tests are normally conducted at one place. In the case of tests conducted at more than one place, guidance is provided in TGP/9 "Examining Distinctness" [http://www.upov.int/edocs/tgpdocs/en/tgp\\_9.pdf](http://www.upov.int/edocs/tgpdocs/en/tgp_9.pdf).

### **3.3 Conditions for Conducting the Examination**

The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination.

The optimum stage of development for the assessment of each characteristic is indicated by a number in the third column of the Table of Characteristics. The stages of development denoted by each number are described in Chapter 8.3.

### **3.4 Test design**

Each test should be designed to result in a total of at least 40 plants in the case of inbred lines and single hybrids and 60 plants in the case of other hybrids and open-pollinated varieties. Each test should be divided between at least 2 replicates.

If panicle rows are conducted, at least 8 panicle rows should be observed.

In case of hybrids, the parent lines have to be included in the test, should be tested, and assessed as any other self-pollinating variety.

The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations, which must be made up to the end of the growing cycle.

### **3.5 Additional tests**

In accordance with Article 83(3) of Council Regulation No. 2100/94 an applicant may claim either in the Technical Questionnaire or during the test that a candidate has a characteristic which would be helpful in establishing distinctness. If such a claim is made and is supported by reliable technical data, an additional test may be undertaken providing that a technically acceptable test procedure can be devised.

Additional tests will be undertaken, with the agreement of the President of CPVO, where distinctness is unlikely to be shown using the characters listed in the protocol.

### **3.6 Constitution and maintenance of a variety collection**

The process for the constitution and the maintenance of a variety collection can be summarized as follows:

Step 1: Making an inventory of the varieties of common knowledge

Step 2: Establishing a collection ("variety collection") of varieties of common knowledge which are relevant for the examination of distinctness of candidate varieties

Step 3: Selecting the varieties from the variety collection which need to be included in the growing trial or other tests for the examination of distinctness of a particular candidate variety.

#### **3.6.1 Forms of variety collection**

The variety collection shall comprise variety descriptions and living plant material, thus a living reference collection. The variety description shall be produced by the EO unless special cooperation exists between EOs and the CPVO. The descriptive and pictorial information produced by the EO shall be held and maintained in a form of a database.

#### **3.6.2 Living Plant Material**

The EO shall collect and maintain living plant material of varieties of the species concerned in the variety collection.

#### **3.6.3 Range of the variety collection**

The living variety collection shall cover at least those varieties that are suitable to climatic conditions of a respective EO.

#### **3.6.4 Making an inventory of varieties of common knowledge for inclusion in the variety collection**

The inventory shall take into account the list of protected varieties and the official, or other, registers of varieties, in particular:

The inventory shall include varieties protected under National PBR (UPOV contracting parties) and Community PBR, varieties registered in the Common Catalogue, the OECD list, the Conservation variety list and varieties in trade or in commercial registers for those species not covered by a National or the Common Catalogue.

The variety collection shall include all varieties used as components (generally inbred lines) of all the hybrid varieties included in the variety collection, as well as varieties of common knowledge in their own right.

#### **3.6.5 Maintenance and renewal/update of a living variety collection**

The EO shall maintain seeds in conditions which will ensure germination and viability, periodical checks, and renewal as required. For the renewal of existing living material the identity of replacement living plant material shall be verified by conducting side-by-side plot comparisons between the material in the collection and the new material.

## **4. ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY**

The prescribed procedure is to assess distinctness, uniformity and stability in a growing trial.

### **4.1 Distinctness**

#### **4.1.1 General recommendations**

It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 9 'Examining Distinctness' ([http://www.upov.int/edocs/tgpdocs/en/tgp\\_9.pdf](http://www.upov.int/edocs/tgpdocs/en/tgp_9.pdf)) prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in this Technical Protocol.

To assess distinctness of hybrids, a pre-screening system on the basis of the parental lines and the formula may be established according to the following recommendations:

- i. description of parental lines according to the Technical Protocols;
- ii. check of the distinctness of the parental lines in comparison with the reference collection, based on the characteristics in the table of characteristics in order to screen the closest inbred lines;
- iii. check of the distinctness of the hybrid formula in comparison with those of the hybrids in common knowledge, taking into account the closest inbred lines;
- iv. assessment of the distinctness at the hybrid level of varieties with a similar formula.

Further guidance is provided in documents TGP/9 "Examining Distinctness" and TGP/8 "Trial Design and Techniques Used in the Examination of Distinctness, Uniformity and Stability".

#### 4.1.2 Consistent differences

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent. One means of ensuring that a difference in a characteristic, observed in a growing trial, is sufficiently consistent is to examine the characteristic in at least two independent growing cycles.

#### 4.1.3 Clear differences

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, i.e. whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner. Therefore, it is important that users of these Technical Protocols are familiar with the recommendations contained in the UPOV-General Introduction to DUS prior to making decisions regarding distinctness.

If distinctness is assessed using the t-test least significant difference the difference between two varieties is clear if it occurs with the same sign at the 1% significance level or less ( $p < 0.01$ ) in two consecutive or two out of three growing cycles.

If distinctness is assessed by the combined over years distinctness analysis (COYD) the difference between two varieties is clear if the respective characteristics are different at the 1% significance level or less ( $p < 0.01$ ) in a test over either two or three years.

If the significance level or statistical methods proposed are not appropriate the method used should be clearly described.

#### 4.1.4 Number of plants/parts of plants to be examined

Inbred lines and single hybrids: Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 10 plants or parts taken from each of 10 plants and any other observations made on all plants in the test, disregarding any off-type plants.

Other types of hybrids: Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 20 plants or parts taken from each of 20 plants and any other observations made on all plants in the test, disregarding any off-type plants.

Open-pollinated varieties: Unless otherwise indicated, for the purposes of distinctness, all observations on single plants should be made on 40 plants or parts taken from each of 40 plants and any other observations made on all plants in the test, disregarding any off-type plants.

#### 4.1.5 Method of observation

The recommended method of observing the characteristic for the purposes of distinctness is indicated by the following key in the third column of the Table of Characteristics (see document TGP/9 "Examining Distinctness", Section 4 "Observation of characteristics"):

MG: single measurement of a group of plants or parts of plants

MS: measurement of a number of individual plants or parts of plants

VG: visual assessment by a single observation of a group of plants or parts of plants

VS: visual assessment by observation of individual plants or parts of plants

Type of observation: visual (V) or measurement (M)

"Visual" observation (V) is an observation made on the basis of the expert's judgment. For the purposes of this document, "visual" observation refers to the sensory observations of the experts and, therefore, also includes smell, taste and touch. Visual observation includes observations where the expert uses reference points (e.g. diagrams, example varieties, side-by-side comparison) or non-linear charts (e.g. colour charts). Measurement (M) is an objective observation against a calibrated, linear scale e.g. using a ruler, weighing scales, colorimeter, dates, counts, etc.

Type of record: for a group of plants (G) or for single, individual plants (S)

For the purposes of distinctness, observations may be recorded as a single record for a group of plants or parts of plants (G), or may be recorded as records for a number of single, individual plants or parts of plants (S). In most cases, "G" provides a single record per variety and it is not possible or necessary to apply statistical methods in a plant-by-plant analysis for the assessment of distinctness.

In cases where more than one method of observing the characteristic is indicated in the Table of Characteristics (e.g. VG/MG), guidance on selecting an appropriate method is provided in document TGP/9, Section 4.2.

## **4.2 Uniformity**

4.2.1 It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 10 'Examining Uniformity' ([http://www.upov.int/edocs/tgpdocs/en/tgp\\_10.pdf](http://www.upov.int/edocs/tgpdocs/en/tgp_10.pdf)) prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in this Technical Protocol:

4.2.2 For the assessment of uniformity of inbred lines and single hybrids, a population standard of 3% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 40 plants, 3 off-types are allowed.

In addition, the same population standard and acceptance probability should apply to clear cases of out-crossed plants in inbred lines as well as plants obviously resulting from selfing of a parent line in single-cross hybrids.

4.2.3 For the assessment of uniformity of inbred lines, in a sample of 8 panicle rows, plants or parts of plants, a population standard of 3 % and an acceptance probability of at least 95 % should be applied. In the case of a sample size of 8 panicle rows, plants or parts of plants, 1 off-type is allowed. A panicle row is considered an off-type panicle row if there is more than 1 off-type plant within that panicle row.

4.2.4. The assessment of uniformity for three-way-cross hybrids, double-cross hybrids and open pollinated varieties, the variability within the variety should not exceed the variability of comparable varieties already known.

4.2.5 The assessment of uniformity for open-pollinated varieties should be according to the recommendations for cross-pollinated varieties in the UPOV-General Introduction to DUS.

## **4.3 Stability**

4.3.1 It is of particular importance for users of this Technical Protocol to consult the UPOV-General Introduction to DUS (link in chapter 1 of this document) and TGP 11 'Examining Stability' ([http://www.upov.int/edocs/tgpdocs/en/tgp\\_11.pdf](http://www.upov.int/edocs/tgpdocs/en/tgp_11.pdf)). In practice, it is not usual to perform tests of stability that produce results as certain as those of the testing of distinctness and uniformity. However, experience has demonstrated that, for many types of variety, when a variety has been shown to be uniform, it can also be considered to be stable.

4.3.2 Where appropriate, or in cases of doubt, stability may be further examined by testing a new seed stock to ensure that it exhibits the same characteristics as those shown by the initial material supplied.

4.3.3 Where appropriate, or in cases of doubt, the stability of a hybrid variety may, in addition to an examination of the hybrid variety itself, also be assessed by examination of the uniformity and stability of its parent lines.

## **5. GROUPING OF VARIETIES AND ORGANIZATION OF THE GROWING TRIAL**

**5.1** The selection of varieties of common knowledge to be grown in the trial with the candidate varieties and the way in which these varieties are divided into groups to facilitate the assessment of distinctness are aided by the use of grouping characteristics.

**5.2** Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctness; and (b) to organize the growing trial so that similar varieties are grouped together.

**5.3** The following have been agreed as useful grouping characteristics.

- a) Leaf: colour of midrib (characteristic 5)
- b) Plant: time of panicle emergence (characteristic 7)
- c) Stigma: colour (characteristic 10)
- d) Flower: self-fertility (characteristic 13)
- e) Plant: length (characteristic 18)
- f) Panicle: density at maturity (characteristic 25)
- g) Panicle: position of broadest part (characteristic 26)
- h) Grain: colour (characteristic 29)

**5.4** If other characteristics than those from the TP are used for the selection of varieties to be included into the growing trial, the EO shall inform the CPVO and seek the prior consent of the CPVO before using these characteristics.

## **6. INTRODUCTION TO THE TABLE OF CHARACTERISTICS**

### **6.1 Characteristics to be used**

The characteristics to be used in DUS tests and preparation of descriptions shall be those referred to in the table of characteristics. All the characteristics shall be used, providing that observation of a characteristic is not rendered impossible by the expression of any other characteristic, or the expression of a characteristic is prevented by the environmental conditions under which the test is conducted or by specific legislation on plant health. In the latter case, the CPVO should be informed.

The Administrative Council empowers the President, in accordance with Article 23 of Commission Regulation N°874/2009, to insert additional characteristics and their expressions in respect of a variety.

#### **States of expression and corresponding notes**

In the case of qualitative and pseudo-qualitative characteristics, all relevant states of expression are presented in the characteristic. However, in the case of quantitative characteristics with 5 or more states, an abbreviated scale may be used to minimize the size of the Table of Characteristics. For example, in the case of a quantitative characteristic with 9 states, the presentation of states of expression in the Test Guidelines may be abbreviated as follows:

State	Note
small	3
medium	5
large	7

However, it should be noted that all of the following 9 states of expression exist to describe varieties and should be used as appropriate:

State	Note
very small	1
very small to small	2
small	3
small to medium	4
medium	5
medium to large	6
large	7
large to very large	8
very large	9

### **6.2 Example Varieties**

Where appropriate, example varieties are provided to clarify the states of expression of each characteristic.



### 6.3 Legend

For the CPVO N° column:

G	Grouping characteristic	– see Chapter 5
QL	Qualitative characteristic	
QN	Quantitative characteristic	
PQ	Pseudo-qualitative characteristic	
(+)	See Explanations on the Table of Characteristics in Chapter 8.2	

For the UPOV N° column:

The numbering of the characteristics is provided as a reference to the UPOV guideline.

(*)	UPOV Asterisked characteristic – Characteristics that are important for the international harmonization of variety descriptions.
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For the column "stage, method":

MG, MS, VG, VS	- see Chapter 4.1.5
(a)–(c)	Explanations covering several Characteristics - see Chapter 8.1
19 - 89	Growth stage key - see Chapter 8.3

## 7. TABLE OF CHARACTERISTICS

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>1.</b>  <b>QN</b>	<b>1.</b>	<b>12-14 VG</b>	<b>Seedling: anthocyanin coloration of coleoptile</b>		
			absent or very weak	Aralba, Argence	1
			weak	Aneto, PR85G85	3
			medium	Cellu, Dorado E	5
			strong	Piper	7
			very strong		9
<b>2.</b> <b>(+)</b>  <b>QN</b>	<b>2.</b>	<b>15 VG</b>	<b>Leaf: anthocyanin coloration of blade</b>		
			absent or very weak	Albita, Double TX	1
			weak	Alpilles, Solarius	3
			medium	PR85G85	5
			strong		7
			very strong		9
<b>3.</b> <b>(+)</b>  <b>QN</b>	<b>3.</b>	<b>41-49 MS/MG /VG</b>	<b>Plant: number of tillers</b>		
			absent or very few	PR83G66, Velox 701	1
			few	Gardavan, PR82G10	2
			medium	Nutri Honey	3
			many	NS-Dziin, Zöldike	4
			very many		5
<b>4.</b>  <b>QN</b>	<b>4.</b>	<b>45-59 VG</b>  <b>(a)</b>	<b>Leaf: intensity of green colour</b>		
			very light		1
			light	Nectar	2
			medium	Grazer, P8500	3
			dark	GK ZSófia	4
			very dark		5

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note		
<b>5.</b>	<b>5.</b> <b>(*)</b>	<b>45-59</b> <b>VG</b>	<b>Leaf: colour of midrib</b>				
			<b>PQ</b>	<b>(a)</b>	white	Dorado E, Gardavan	1
					yellowish white	Beefbuilder, Vidan 697	2
					light green		3
					light yellow	PR82G55, PR87G57	4
					medium yellow	P8500	5
					<b>G</b>	dark yellow	Digestivo
	brownish	Teide	7				
<b>6.</b> <b>(+)</b>	<b>6.</b>	<b>45-59</b> <b>VG</b>	<b>Leaf: area of discoloration of midrib</b>				
			<b>QN</b>	<b>(a)</b>	absent or very small	Balto	1
					small		3
					medium	Super Sile 20	5
					large	Primsilo	7
					very large		9
<b>G</b>							
<b>7.</b> <b>(+)</b>	<b>7.</b> <b>(*)</b>	<b>51</b> <b>MG/MS</b>	<b>Plant: time of panicle emergence</b>				
			<b>QN</b>		very early	Ludan	1
					early	Artaban, Artigas	3
					medium	Albita, Dorado DR	5
					late	Béreny, PR82G55	7
					<b>G</b>	very late	
<b>8.</b>	<b>8.</b>	<b>65-69</b> <b>VG</b>	<b>Glume: anthocyanin coloration</b>				
			<b>QN</b>	<b>(b)</b>	absent or very weak	Dorado E, Grazer	1
					weak	Nicol	3
					medium		5
					strong		7
					very strong		9

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note	
<b>9.</b>  <b>QN</b>	<b>9.</b>	<b>65-69 VG</b>  <b>(b)</b>	<b>Stigma: anthocyanin coloration</b>			
			absent or very weak	Grazer, P8500	1	
			weak		3	
			medium		5	
			strong		7	
			very strong		9	
<b>10.</b> <b>(+)</b>  <b>PQ</b>    <b>G</b>	<b>10.</b> <b>(*)</b>	<b>65-69 VG</b>  <b>(b)</b>	<b>Stigma: colour</b>			
			white	P8500	1	
			light yellow	Albita	2	
			medium yellow	Argence, Dorado E	3	
			dark yellow	Digestivo, Nutri Honey	4	
			grey	Nectar, Vidan 697	5	
<b>11.</b> <b>(+)</b>  <b>QN</b>	<b>11.</b>	<b>65-69 VG</b>  <b>(b)</b>	<b>Stigma: length</b>			
			very short		1	
			short	Aralba, Velox 701	2	
			medium	Dorado E, Nutri Honey	3	
			long	Arfrio, PR82G55	4	
			very long		5	
<b>12.</b> <b>(+)</b>  <b>QN</b>	<b>12.</b>	<b>65-69 VG</b>  <b>(b)</b>	<b>Flower with pedicel: length of flower</b>			
			very short		1	
			short	Nicol, PR82G55	3	
			medium	Aneto, Gardavan	5	
			long	SF2003	7	
			very long		9	

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note		
<b>13.</b> <b>(+)</b>	<b>13.</b> <b>(*)</b>	<b>65-69</b> <b>VG</b>	<b>Flower: self-fertility</b>				
			<b>QN</b>	absent or very low		1	
				medium		2	
<b>G</b>			high	Aneto, P8500	3		
<b>14.</b>	<b>14.</b>	<b>65-69</b> <b>VG</b>	<b>Glume: colour <u>at end of flowering</u></b>				
			<b>PQ</b>	(b)	light green		1
					medium green		2
					yellow green	Grazer, PR82G55	3
					light yellow	Nutri Honey	4
			medium yellow	Teide	5		
<b>15.</b>	<b>15.</b>	<b>65-69</b> <b>VG</b>	<b>Panicle: density <u>at end of flowering</u></b>				
			<b>QN</b>	(b)	very sparse		1
					sparse	Digestivo, Gardavan	3
					medium	Argence, Nutri Honey	5
					dense	PR82G55, PR85G85	7
			very dense	Velox 701	9		
<b>16.</b> <b>(+)</b>	<b>16.</b> <b>(*)</b>	<b>69-75</b> <b>VG</b>	<b>Lemma: length of arista</b>				
			<b>QN</b>	(b)	absent or very short	Dorado E, Grazer	1
					short	Lussi, Nectar	3
					medium	Digestivo, SF 2003	5
					long	Vidan 697	7
			very long		9		

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>17.</b>	<b>17.</b>	<b>69-75</b>	<b>Dry anther: colour</b>		
	<b>(*)</b>	<b>VG</b>			
<b>PQ</b>		<b>(b)</b>	light yellow		1
			greyish pink		2
			orange	Dorado DR, Gardavan	3
			orange red	Elite, PR82G55	4
			red		5
			red brown		6
<b>18.</b>	<b>18.</b>	<b>75-85</b>	<b>Plant: length</b>		
<b>(+)</b>	<b>(*)</b>	<b>MS</b>			
<b>QN</b>			dwarf		1
			dwarf to extremely short		2
			extremely short	Sibelus	3
			extremely short to very short	Aruski	4
			very short	PR88Y20	5
			very short to short	Albita	6
			short	PR84G62	7
			short to medium	PR82G55	8
			medium	Jumak	9
			medium to tall	Topsilo	10
			tall	Zöldike	11
			tall to very tall	Zöldözön	12
			very tall	Rona 1	13
			very tall to extremely tall	Agnes	14
			extremely tall	Gardavan	15
			extremely tall to giant		16
<b>G</b>			giant		17

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>19.</b>	<b>19.</b>	<b>69-85 MS/VG</b>	<b>Stem: diameter</b>		
<b>QN</b>		<b>(c)</b>	small	SF2003, Vidan 697	3
			medium	Cellu, Double TX, PR88Y20	5
			large	Elite	7
<b>20.</b>	<b>20.</b>	<b>75-85 VG/MS</b>	<b>Leaf: length of blade</b>		
<b>QN</b>		<b>(a)</b>	very short		1
			short	Buggy	3
			medium	Choice, Vidan 697	5
			long	SF2003	7
			very long		9
<b>21.</b>	<b>21.</b>	<b>75-85 VG/MS</b>	<b>Leaf: width of blade</b>		
<b>QN</b>		<b>(a)</b>	very narrow		1
			narrow	Maya, Vidan 697	3
			medium	Aneto	5
			broad	Beefbuilder, P8500	7
			very broad		9
<b>22. (+)</b>	<b>22. (*)</b>	<b>75-85 VG/MS</b>	<b>Panicle: length</b>		
<b>QN</b>			very short		1
			short	Iggloo, Nectar	3
			medium	Aneto, Dorado Dr	5
			long	Jimggo	7
			very long		9

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note	
23. (+)	23.	75-85 VG/MS	<b>Panicle: length of neck</b>			
			<b>QN</b>	absent or very short	PR84G62	1
				short	Nectar, Profus	3
				medium	Nicol, SF2003	5
				long	Arlys, Vidan 697	7
			very long		9	
24.	24.	75-85 VG/MS	<b>Panicle: length of primary lateral branches</b>			
			<b>QN</b>	(b) short	Beefbuilder, Nectar	3
				medium	Grazer, Nicol	5
			long	Gardavan	7	
25.	25. (*)	92-93 VG	<b>Panicle: <u>density at maturity</u></b>			
			<b>QN</b>	very sparse	DK18, Gardavan	1
				sparse	Grazer, SF2003	3
				medium	Argence	5
				dense	Nectar, PR85G85	7
<b>G</b>			very dense	Albita, Velox 701	9	
26. (+)	26. (*)	92-93 VG	<b>Panicle: position of broadest part</b>			
			<b>QN</b>	very low		1
				low	PR84G62	2
				medium	Nutri Honey	3
				high	Beefbuilder	4
<b>G</b>			very high	Vidan 697	5	



CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note	
<b>27.</b>	<b>27.</b> <b>(*)</b>	<b>92-93</b> <b>VG</b>	<b>Glume: colour <u>at maturity</u></b>			
			<b>PQ</b>	white		1
				light yellow	PR88Y20	2
				medium yellow	Dorado E, Nectar	3
				light brown	Grazer	4
				reddish brown	Argence, P8500	5
				dark brown	PR82G55, Velox 701	6
				black	Digestivo, Vidan 697	7
<b>28.</b> <b>(+)</b>	<b>28.</b>	<b>92-93</b> <b>VG</b>	<b>Glume: length</b>			
			<b>QN</b>	very short		1
				short	PR83G66, PR87G57	3
				medium	Aralba, PR85G85	5
				long	Digestivo, Nutri Honey	7
				very long		9
<b>29.</b> <b>(+)</b>	<b>29.</b> <b>(*)</b>	<b>92-93</b> <b>VG</b>	<b>Grain: colour</b>			
			<b>PQ</b>	white	Choice	1
				yellowish white	Aralba, PR88Y20	2
				grey white	Albita	3
				light yellow	Beefbuilder, Gardavan	4
				orange	Argence, PR85G85	5
				orange red	PR82G55, PR83G66	6
				light brown	Velox 701	7
				red brown	Nutri Honey, PR82G10	8
				dark brown	Nicol, Vidan 697	9
				purple		10
<b>G</b>	black		11			

CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note
<b>30.</b>	<b>30.</b>	<b>92-93 MG</b>	<b>Weight of 1000 grains</b>		
<b>QN</b>			very low	Velox 701	1
			low	Nicol, PR87G57	3
			medium	Nutri Honey	5
			high	Aralba, PR88Y20	7
			very high		9
<b>31. (+)</b>	<b>31.</b>	<b>92-93 VG</b>	<b>Grain: shape in dorsal view</b>		
<b>PQ</b>			narrow elliptic	Aneto, Vidan 697	1
			broad elliptic	Nectar, Nutri Honey	2
			ovate	Velox 701	3
			circular	Bechna	4
<b>32. (+)</b>	<b>32.</b>	<b>92-93 VG</b>	<b>Grain: size of mark of germ</b>		
<b>QN</b>			very small		1
			small	Digestivo, Grazer	3
			medium	PR84G62, PR83G66	5
			large	Dorado E, PR85G85	7
			very large		9
<b>33. (+)</b>	<b>33.</b>	<b>92-93 MG</b>	<b>Grain: content of tannin</b>		
<b>QN</b>			absent or very low	Albita	1
			medium	PR82G55	2
			very high	Gardavan, Nectar	3

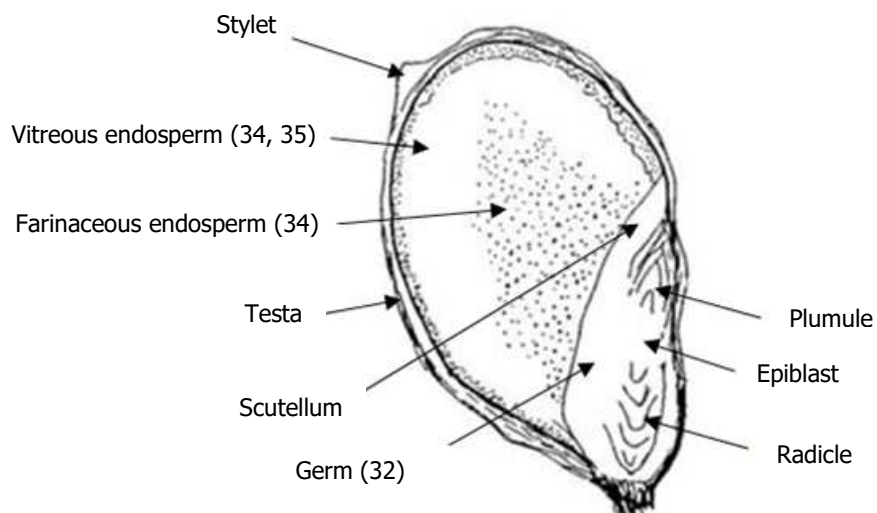
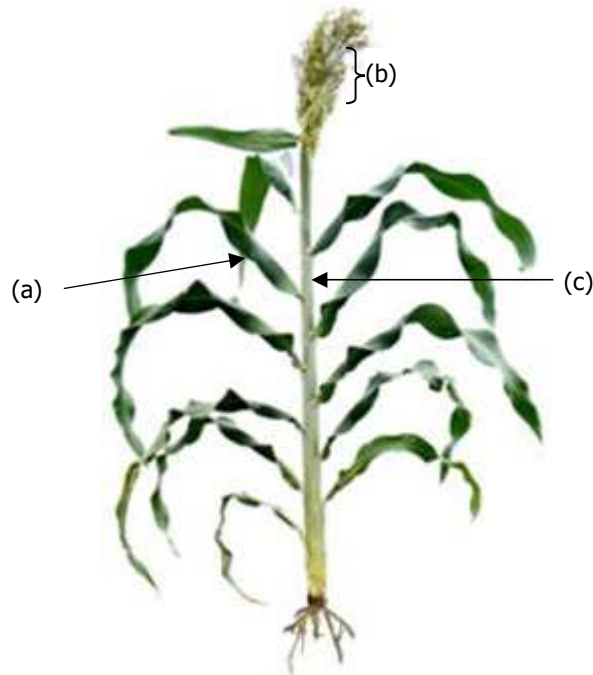
CPVO N°	UPOV N°	Stage, Method	Characteristics	Examples	Note	
<b>34. (+)</b>	<b>34. (* )</b>	<b>92-93 VG</b>	<b>Grain: type of endosperm</b>			
			<b>QN</b>	fully vitreous		1
				$\frac{3}{4}$ vitreous	Nicol, SF2003	2
				half vitreous	Albita, Nectar	3
				$\frac{3}{4}$ farinaceous	Beefbuilder, PR85G85	4
		fully farinaceous	PR83G66, PR82G10	5		
<b>35.</b>	<b>35. (* )</b>	<b>92-93 VG</b>	<b>Grain: colour of vitreous endosperm</b>			
			<b>PQ</b>	white	Sanggat, Sweet Virginia	1
				yellow	Dorado E, PR88Y20	2
				orange	P8500, PR83G66	3
		violet	Nectar, Nicol	4		

## 8. EXPLANATIONS ON THE TABLE OF CHARACTERISTICS

### 8.1 Explanations covering several characteristics

Characteristics containing the following key in the third column of the Table of Characteristics should be examined as indicated below

- (a) Observations should be made on the third leaf from the top of the plant excluding flag leaf.
- (b) Observations should be made in the middle third of the main panicle.
- (c) Observations should be made just above the third leaf from the top of the plant excluding flag leaf.



## 8.2 Explanations for individual characteristics

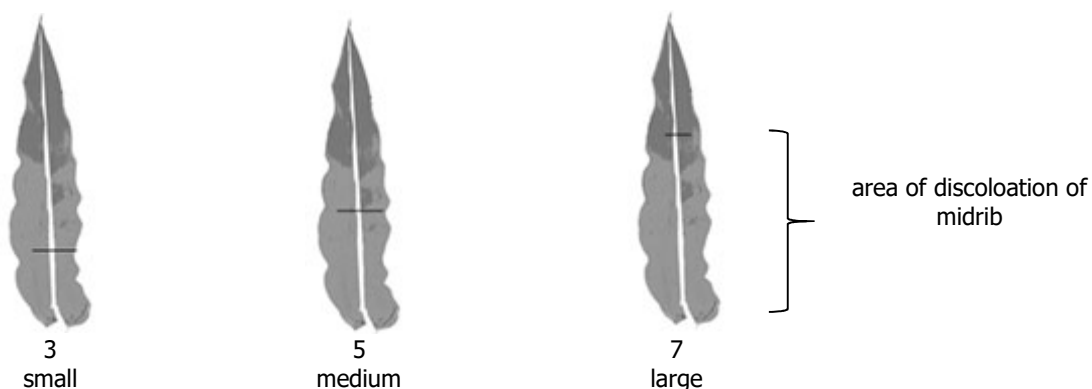
### Ad. 2: Leaf: anthocyanin coloration of blade

The observation should be made on the third leaf from the bottom.

### Ad. 3: Plant: number of tillers

The minimum height necessary to be counted as tiller should be one third of the height of the plant.

### Ad. 6: Leaf: area of discoloration of midrib



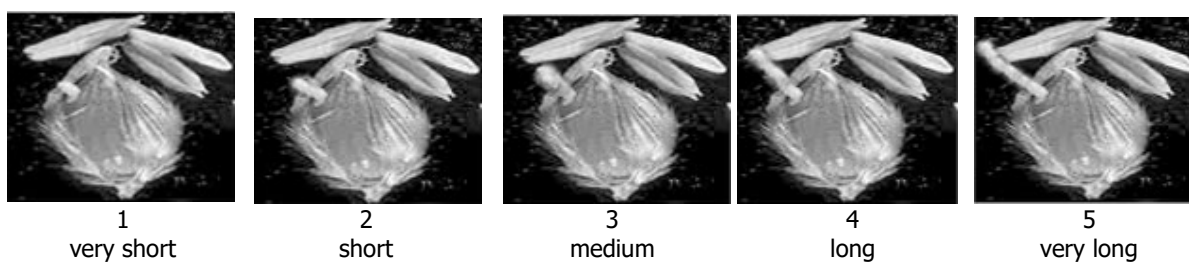
### Ad. 7: Plant: time of panicle emergence

The time of panicle emergence is when the tip of the panicle has emerged from flag leaf sheath on 50% of the plants.

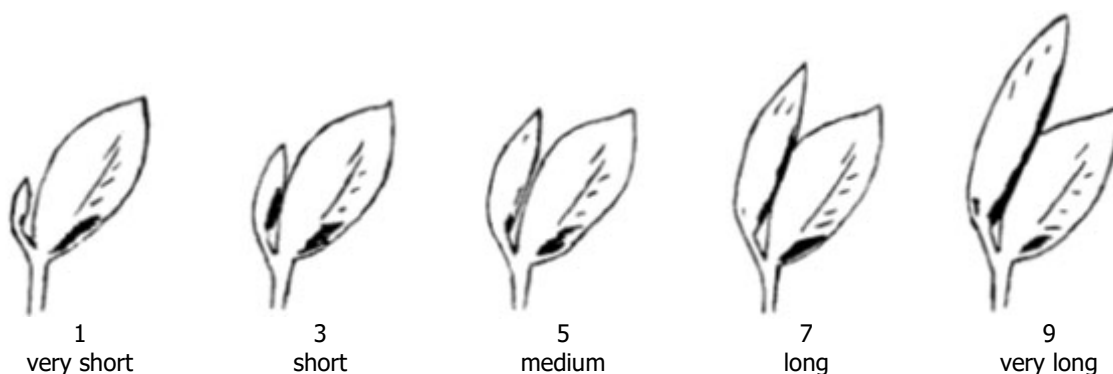
### Ad. 10: Stigma: colour

Impossibility to observe in case of strong anthocyanin coloration.

### Ad. 11: Stigma: length



Ad. 12: Flower with pedicel: length of flower



Ad. 13: Flower: self-fertility

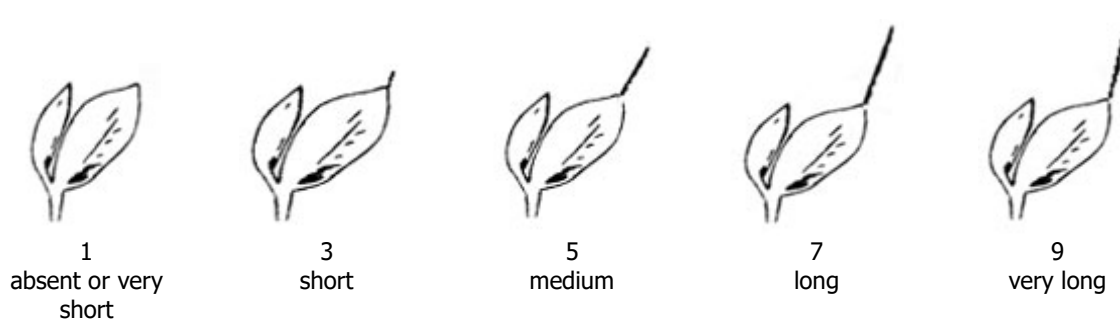
To be observed on 10 plants.

The heads are bagged with selfing bags before flowering. After maturity the bag is removed from each head, the estimated seed set in percentage of total number of florets is recorded.

Panicle: self-fertility

- 1 absent or very low: 0% - 10%
- 2 medium: 11% - 70%
- 3 high: 71% - 100%

Ad. 16: Lemma: length of arista



Ad. 18: Plant: length

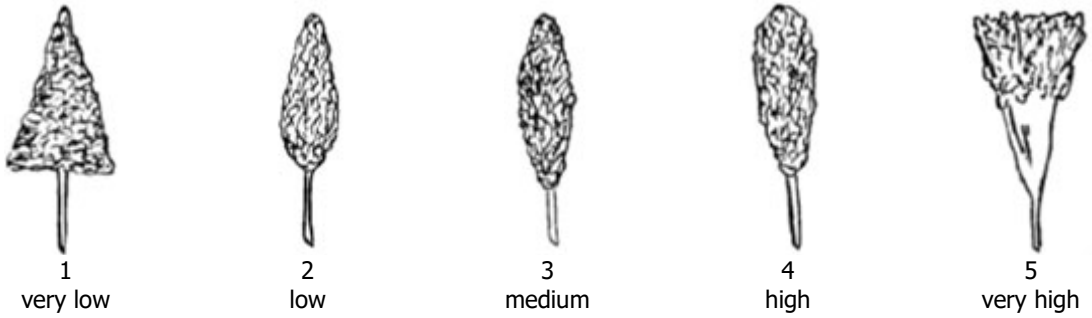
Plant length should be observed from ground level to the top of the panicle.

Ad. 22: Panicle: length

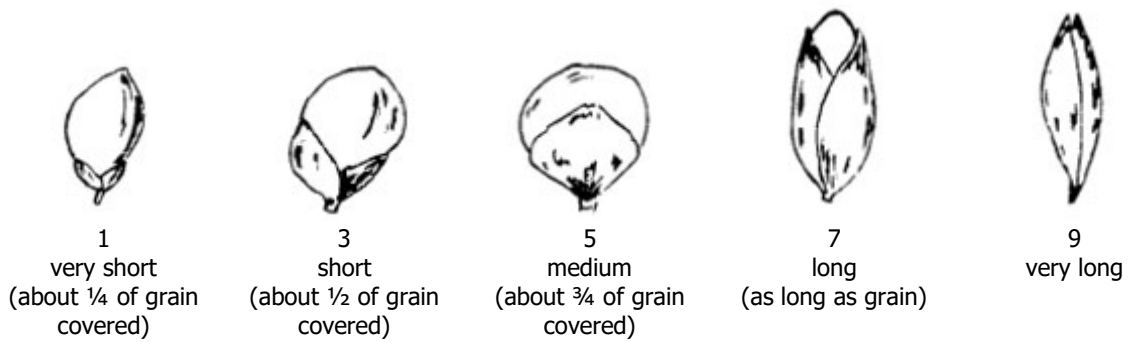
Ad. 23: Panicle: length of neck

The neck is between flag leaf and first ramification of the panicle. The assessment of panicle length should be made without the neck.

Ad. 26: Panicle: position of broadest part



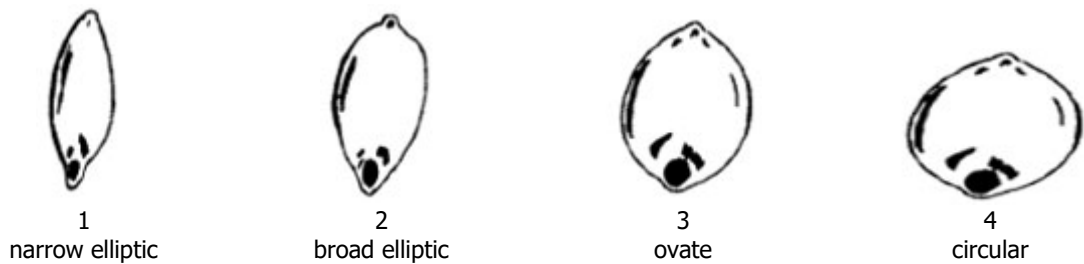
Ad. 28: Glume: length



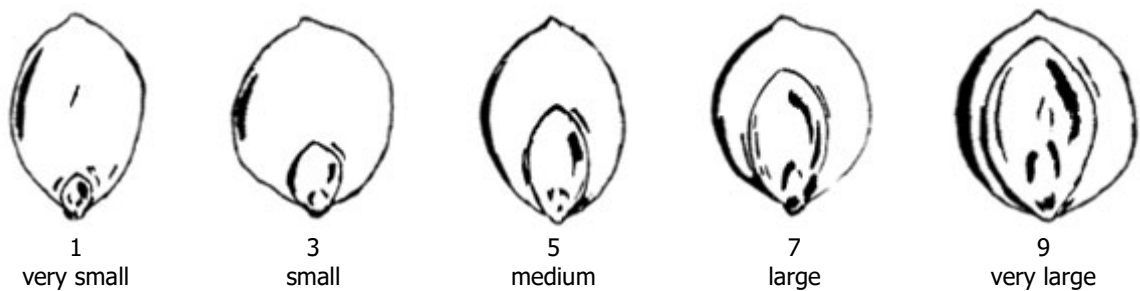
Ad. 29: Grain: colour

The colour of the grain should be observed after threshing.

Ad. 31: Grain: shape in dorsal view



Ad. 32: Grain: size of mark of germ



Ad. 33: Grain: content of tannin

**METHOD DETECTION OF TANNIN IN SORGHUM GRAIN BY THE BLEACH TEST** (see reference in Chapter 9)

**1. Scope**

Applicable to whole grain sorghum

**2. Definitions**

Certain varieties of sorghum contain proanthocyanidins (commonly referred to as tannins or more strictly speaking condensed tannins) in the seed coat layer beneath the pericarp (commonly referred to as the testa layer) of the grain. These varieties are variously referred to as: tannin, high-tannin, brown, bird proof, bird-resistant, or bitter sorghums.

Varieties of sorghum not containing tannins are variously referred to as: non-tannin, low tannin, condensed tannin-free, or sweet sorghums.

In this Technical Protocol the term "tannin sorghum" shall be used for those sorghums containing tannins and the term "non-tannin sorghum" used for those sorghums not containing tannins.

**3. Principle**

Sorghum grain is immersed in a sodium hypochlorite solution (bleach) containing alkali. The solution dissolves away the outer pericarp layer of sorghum grain, revealing the presence of a black pigmented testa layer in the case of tannin sorghums, or its absence in the case of non-tannin sorghums.

**4. Reagent**

4.1 Bleaching reagent

Five g sodium hydroxide is dissolved in 100 ml of 3.5% sodium hypochlorite solution (commercial bleach). Reagent can be stored at room temperature in light-proof bottle for up to one month.

4.2 Sorghum standards

An appropriate tannin and non-tannin standard.

**5. Apparatus**

Glass beakers (50 ml)  
Tea strainer  
Aluminium foil  
Paper towel

**6. Procedure**

6.1 Test must be performed in duplicate.

6.2 Known tannin sorghum and non-tannin sorghum standards must be included each time the test is performed.

6.3 One hundred whole, sound sorghum grains are placed in a beaker.

6.4 Bleaching reagent is added to just cover the sorghum grains and close beaker with aluminium foil. Too much bleaching reagent will cause over bleaching and give false negative results. If in doubt repeat using less reagent.

6.5 Incubate beaker at room temperature (20-30°C) for 20 minutes, swirling contents of beaker every 5 minutes.

6.6 Empty contents of beaker into tea strainer, discarding bleaching reagent. Rinse sorghum grains in tea strainer with tap water.



6.7 Empty contents of tea strainer onto sheet of paper towel. Spread grains out into a single layer and gently blot them dry with another piece of paper towel.

6.8 Count tannin sorghum grains. Tannin sorghum grains are those grains that are black over the entire surface of the grain, unless the germ is somewhat lighter in colour. Non-tannin sorghum grains are those which are either completely white, or are brown over part of the surface of the grain.

## 7. Presentation of results

7.1 Calculate tannin sorghum grains as percentage of total sorghum grains. Duplicate determinations should not differ by more than +/- 5 grains, for example first determination 90%, second determination 85%, or 95%. The mean of the duplicate determinations should be calculated.

7.2 Expression of results

Results should be expressed as:

Percentage tannin sorghum, e.g. 90% tannin sorghum



1  
absent or very low



2  
medium



3  
very high

### States of expression:

Number of grains to be observed: 100 grains

- 1 absent or very low:  $\leq 5\%$  tannin
- 2 medium:  $>5\%$  -  $<95\%$  tannin
- 3 very high:  $\geq 95\%$  tannin

### Ad. 34: Grain: type of endosperm



1  
fully vitreous



2  
 $\frac{3}{4}$  vitreous



3  
half vitreous



4  
 $\frac{3}{4}$  farinaceous



5  
fully farinaceous

### 8.3 Decimal Code for the Growth Stages of Cereals

This decimal code is in close conformity with the BBCH-code (Witzenberger et al., 1989; Lancashire et al., 1991)

CODE	GENERAL DESCRIPTION
	<b>GERMINATION</b>
00	Dry seed
01	Beginning of seed imbibition
02	
03	Seed imbibition complete
04	
05	Radicle emerged from caryopsis
06	Radicle elongated, root hairs and /or side roots visible
07	Coleoptile emerged from caryopsis
08	
09	Emergence: coleoptile penetrates soil surface (cracking stage)
	<b>LEAF DEVELOPMENT</b>
10	First leaf through coleoptile
11	First leaf unfolded
12	2 leaves unfolded
13	3 leaves unfolded
14	4 leaves unfolded
15	5 leaves unfolded
16	6 leaves unfolded
17	7 leaves unfolded
18	8 leaves unfolded
19	9 or more leaves unfolded
	<b>TILLERING</b>
20	No tillers
21	Beginning of tillering: first tiller detectable
22	2 tillers detectable
23	3 tillers detectable
24	4 tillers detectable
25	5 tillers detectable
26	6 tillers detectable
27	7 tillers detectable
28	8 tillers detectable
29	End of tillering. Maximum no. of tillers detectable.
	<b>STEM ELONGATION</b>
30	Pseudo stem erection
31	1 <sup>st</sup> node detectable
32	2 <sup>nd</sup> node detectable
33	3 <sup>rd</sup> node detectable
34	4 <sup>th</sup> node detectable
35	
36	
37	Flag leaf just visible, still rolled
38	
39	Flag leaf stage: flag leaf fully unrolled, ligule just visible
	<b>BOOTING</b>
40	
41	Early boot stage: flag leaf sheath extending
42	
43	Mid boot stage: flag sheath just visibly swollen
44	
45	Late boot stage: flag leaf sheath swollen
46	
47	Flag leaf sheath opening
48	
49	First awns visible (in awned forms only)

**INFLORESCENCE EMERGENCE, HEADING**

- 50
- 51 Beginning of heading: tip of inflorescence emerged from sheath, first spikelet just visible
- 52 20% of inflorescence emerged
- 53 30% of inflorescence emerged
- 54 40% of inflorescence emerged
- 55 50% of inflorescence emerged
- 56 60% of inflorescence emerged
- 57 70% of inflorescence emerged
- 58 80% of inflorescence emerged
- 59 End of heading: inflorescence fully emerged

**FLOWERING, ANTHESIS**

- 60
- 61 Beginning of flowering: first anthers visible
- 62
- 63
- 64
- 65 Full flowering: 50% of anthers mature
- 66
- 67
- 68
- 69 End of flowering: all spikelets have completed flowering but some dehydrated anthers may remain.

**DEVELOPMENT OF FRUIT**

- 70
- 71 Watery ripe: first grains have reached half their final size
- 72
- 73 Early milk
- 74
- 75 Medium milk: grain content milky, grains reached final size, still green
- 76
- 77 Late milk
- 78
- 79

**RIPENING**

- 80
- 81
- 82
- 83 Early dough
- 84
- 85 Soft dough: grain content soft but dry. Fingernail impression not held.
- 86
- 87 Hard dough: grain content solid. Fingernail impression held
- 88
- 89 Fully ripe: grain hard, difficult to divide with thumbnail

**SENESCENCE**

- 90
- 91
- 92 Over-ripe: grain very hard cannot be dented by thumbnail
- 93 Grains loosening in day-time
- 94
- 95
- 96
- 97 Plant dead and collapsing
- 98
- 99 Harvested product

## 9. LITERATURE

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## **10. TECHNICAL QUESTIONNAIRE**

The Technical Questionnaire is available on the CPVO website under the following reference:  
CPVO/TQ-122/1