



PROTOCOL FOR TESTS ON DISTINCTNESS, UNIFORMITY AND STABILITY

***Avena sativa* L., *Avena nuda* L.**

OATS, NAKED OATS

UPOV Code: AVENA_SAT; AVENA_NUD

Adopted on 01/10/2015

Entry into force on 01/08/2015

TABLE OF CONTENTS

CPVO-TP/020/2

1.	SUBJECT OF THE PROTOCOL AND REPORTING.....	3
1.1	Scope of the technical protocol.....	3
1.2	Entry into Force	3
1.3	Reporting between Examination Office and CPVO and Liaison with Applicant.....	3
2.	MATERIAL REQUIRED	3
2.1	Plant material requirements	3
2.2	Informing the applicant of plant material requirements.....	4
2.3	Informing about problems on the submission of material	4
3.	METHOD OF EXAMINATION.....	4
3.1	Number of growing cycles.....	4
3.2	Testing Place	4
3.3	Conditions for Conducting the Examination.....	4
3.4	Test design.....	4
3.5	Additional tests	4
3.6	Constitution and maintenance of a variety collection	5
4.	ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY	5
4.1	Distinctness	5
4.2	Uniformity	6
4.3	Stability.....	7
5.	GROUPING OF VARIETIES AND ORGANIZATION OF THE GROWING TRIAL.....	7
6.	INTRODUCTION TO THE TABLE OF CHARACTERISTICS	7
6.1	Characteristics to be used	7
6.2	Example Varieties.....	8
6.3	Legend.....	8
7.	TABLE OF CHARACTERISTICS.....	9
8.	EXPLANATIONS ON THE TABLE OF CHARACTERISTICS.....	14
8.1	Explanations covering several characteristics	14
8.2	Explanations for individual characteristics	14
9.	LITERATURE	20
10.	TECHNICAL QUESTIONNAIRE	21

1. SUBJECT OF THE PROTOCOL AND REPORTING

1.1 Scope of the technical protocol

This Technical Protocol applies to all varieties of *Avena sativa* L. and *Avena nuda* L.

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/en/publications/intro_dus.htm), its associated TGP documents (<http://www.upov.int/en/publications/tgp/>) and the relevant UPOV Test Guideline TG/20/10 dated 01/10/1994 (<http://www.upov.int/edocs/tgdocs/en/tg020.pdf>) for the conduct of tests for Distinctness, Uniformity and Stability.

1.2 Entry into Force

The present protocol enters into force on 01/08/2015. Any on-going 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://www.cpvo.europa.eu/main/en/home/documents-and-publications/s2-gazette> 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

- they are 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/export/sites/upov/en/publications/tgp/documents/tgp_9_1.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 2000 plants, which should be divided between at least two replicates.

The assessment of the characteristic "seasonal type" should be designed to result in a total of at least 500 plants.

If ear rows are used, the test should be conducted on at least 100 ear rows.

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.

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/export/sites/upov/en/publications/tgp/documents/tgp_9_1.pdf) prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in this Technical Protocol.

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 2 x 1% criterion, the varieties need to be significantly different in the same direction at the 1% level in at least two out of three years in one or more measured characteristics. The tests in each year are based on Student's two-tailed t-test of the differences between variety means with standard errors estimated using the residual mean square from the analysis of the variety x replicate plot means.

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

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."

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**

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/export/sites/upov/en/publications/tgp/documents/tgp_10_1.pdf) prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in this Technical Protocol:

For the assessment of uniformity in a sample of 2000 plants, a population standard of 0.1 % and an acceptance probability of at least 95 % should be applied. In the case of a sample size of 2000 plants, 5 off-types are allowed.

For the assessment of uniformity in a sample of 100 ear-rows, plants or parts of plants, a population standard of 1 % and an acceptance probability of at least 95 % should be applied. In the case of a sample size of 100 ear-rows, plants or parts of plants, 3 off-types are allowed.

An ear-row is considered to be an off-type ear-row if there is more than 1 off-type plant within that ear-row.

The recommended sample size for the assessment of uniformity is indicated by the following key in the table of characteristics:

{A} sample size of 100
{B} sample size of 2000

For characteristics with the key "A" in the list of characteristics the assessment of uniformity can be done in 2 steps. In a first step, 20 plants or parts of plants are observed. If no off-types are observed, the variety is declared to be uniform. If more than 3 off-types are observed, the variety is declared not to be uniform. If 1 to 3 off-types are observed, an additional sample of 80 plants or parts of plants must be observed.

A re-submission of plant material may be allowed for the second growing cycle if in the first growing cycle the number of off-types did not exceed 15 plants in a sample size of 2000 plants (Population standard of 0.5% with an acceptance probability of $\geq 95\%$) or 9 plants, parts of plants or ear rows in a sample size of 100 (Population standard of 5% with an acceptance probability of $\geq 95\%$).

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/export/sites/upov/en/publications/tgp/documents/tgp_11_1.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.

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) Stem: hairiness of uppermost node (characteristic 6)
- (b) Primary grain: intensity of glaucosity of lemma (characteristic 11)
- (c) Grain: colour of lemma (characteristic 17)
- (d) Seasonal type (characteristic 22)

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 ad hoc 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":

00 – 99	See Explanations on the Table of Characteristics in Chapter 8.3
MG, MS, VG, VS	Method of observation – see Chapter 4.1.5
A	Sample size 100 – see Chapter 4.2
B	Sample size 2000 – see Chapter 4.2

For the column "characteristics":

A.s.	<i>Avena sativa</i> L.
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7. TABLE OF CHARACTERISTICS

CPVO N°	UPOV N°	Stage Method	Characteristics	Examples Winter	Examples Spring	Note	
1. (+)	1.	25-29	Plant: growth habit				
			VG	erect		1	
			B	semi-erect		Canyon	3
				intermediate		Atego	5
				semi prostrate			7
				prostrate			9
2. (+)	2.	25-29	Lowest leaves: hairiness of sheaths				
			VG	absent or very weak		1	
			A	weak		3	
				medium		5	
				strong		7	
				very strong		9	
3. (+)	3.	40-45	Leaf blade: hairiness of margins of leaf below flag leaf				
			VG	absent or very weak		1	
			A	weak		3	
				medium		5	
				strong		7	
				very strong		9	
4. (+)	4.	47-51	Plant: frequency of plants with recurved flag leaves				
			VG	absent or very low		1	
			B	low		3	
				medium		5	
				high		7	
				very high		9	

CPVO N°	UPOV N°	Stage Method	Characteristics	Examples Winter	Examples Spring	Note		
5.	5.	50-52	Time of panicle emergence (first spikelet visible on 50% of panicles)					
			MG	very early			1	
			B	early	Maestro	Olympic	3	
				medium	Mascani	Gabby	5	
				late	Mason	SW Argyle	7	
	very late			9				
6	6.	60-65	Stem: hairiness of uppermost node					
			VG	absent	Gerald	Canyon	1	
G		A	present	Mascani	Scorpion	9		
7.	7.	60-65	Stem: intensity of hairiness of uppermost node					
			(+) VG	very weak			1	
				A	weak			3
					medium			5
					strong			7
	very strong				9			
8.	9.	70-75	Panicle: attitude of branches					
			(+) VG	erect			1	
				A	semi-erect			3
					horizontal			5
					drooping			7
	strongly drooping				9			
9.	11.	65-69	Glumes: glaucosity					
			VG	absent or very weak			1	
			B	weak	Hendon	Canyon	3	
				medium		Atego	5	
				strong		Belinda	7	
	very strong			9				

CPVO N°	UPOV N°	Stage Method	Characteristics	Examples Winter	Examples Spring	Note	
10.	12.	70-75	Glumes: length				
		MS	short			3	
		A	medium	Mascani	Canyon	5	
			long			7	
11.	13.+14.	70-75	Primary grain: intensity of glaucosity of lemma				
		(#) ¹	VG	absent or very weak	Mascani	Canyon	1
			A	weak			3
				medium			5
				strong		Gabby	7
G		very strong			9		
12.	15.	80-85	Plant: length (stem and panicle)				
		MG	very short	Hendon		1	
		B	short	Fergus		3	
			medium	Mascani		5	
			long	Gerald	SW Argyle	7	
		very long			9		
13.	16.	80-85	Panicle: length				
		MS/VG	very short			1	
		A	short			3	
			medium	Balado	Firth	5	
			long			7	
		very long			9		
14.	17.	92	Grain: husk				
		VG	absent	Hendon	Lennon	1	
		A	present	Mascani	Canyon	9	

¹ Not applicable for naked type

CPVO N°	UPOV N°	Stage Method	Characteristics	Examples Winter	Examples Spring	Note
15. (#)	18.	92	Primary grain: tendency to be awned			
		VG	absent or very weak		Flämingsprofi	1
		A	weak	Grafton		3
			medium	Bastion		5
			strong			7
			very strong			9
16. (#)	19.	92	Primary grain: length of lemma			
		MS	very short			1
		A	short	RGT Victorious	Firth	3
			medium	SW Dalguise	Canyon	5
			long			7
	very long			9		
17. (#)	20.	92	Grain: colour of lemma			
		VG	white	Gerald	Firth	1
		A	yellow	Mascani	Canyon	2
			brown			3
			grey			4
		G	black			5
18. (+) (#)	21.	92	Primary grain: hairiness of back of lemma (except for white and yellow oats)			
		VG	absent			1
		A	present			9
19. (+) (#)	22.	92	Primary grain: hairiness of base			
		VG	absent or very weak			1
		A	weak			3
			medium			5
			strong			7
	very strong			9		

CPVO N°	UPOV N°	Stage Method	Characteristics	Examples Winter	Examples Spring	Note
20.	23.	92	Primary grain: length of basal hairs			
(+)		VG	short			3
(#)		A	medium			5
			long			7
21.	24.	92	Primary grain: length of rachilla			
(+)		VG	short			3
(#)		A	medium			5
			long			7
22.			Seasonal type			
		VG	winter type	Mascani		1
		B	alternative type			2
G			spring type		SW Argyle	3

8. EXPLANATIONS ON THE TABLE OF CHARACTERISTICS

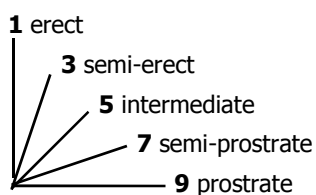
8.1 Explanations covering several characteristics

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

(a) All observations on the spikelet should be made in the mid-third of the ear.

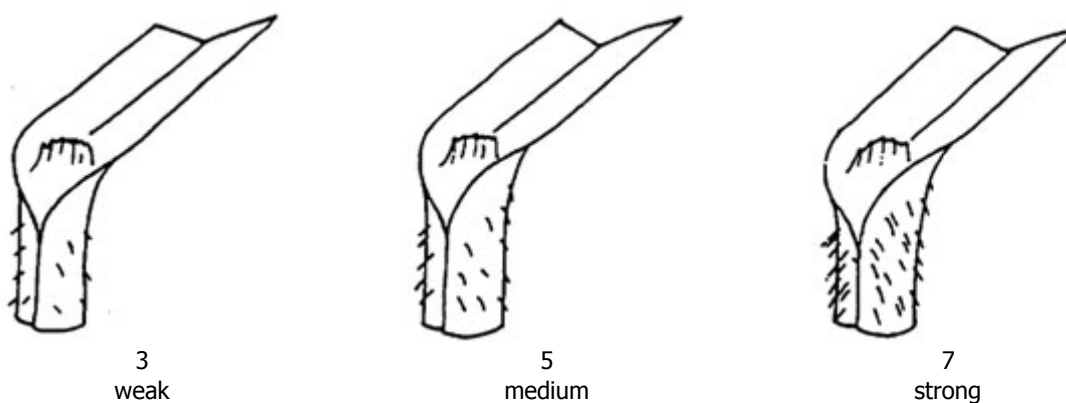
8.2 Explanations for individual characteristics

Ad. 1: Plant: growth habit

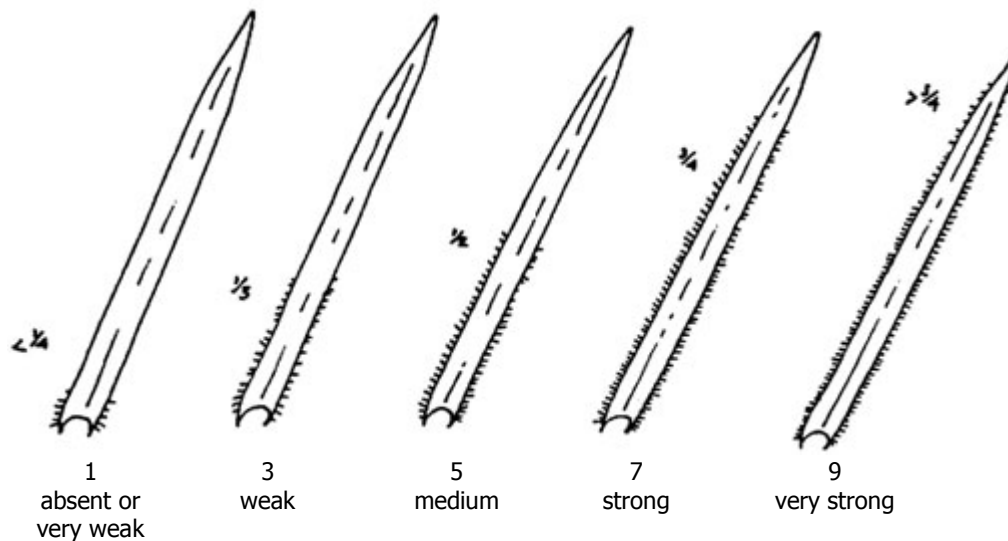


The growth habit should be assessed visually from the attitude of the leaves and tillers. The angle formed by the outer leaves and the tillers with an imaginary vertical axis should be used.

Ad 2: Lowest leaves: hairiness of sheaths



Ad 3: Leaf blade: hairiness of margins of leaf below flag leaf



Ad 4: Plant: frequency of plants with recurved flag leaves

- 1..... all flag leaves are rectilinear
- 3..... about 1/4 of the plants with recurved flag leaves
- 5..... about 1/2 of the plants with recurved flag leaves
- 7..... about 3/4 of the plants with recurved flag leaves
- 9..... all flag leaves are recurved

Ad 7: Stem: intensity of hairiness of uppermost node



3
weak



5
medium



7
strong

Ad 8: Panicle: attitude of branches



1
erect



3
semi-erect



5
horizontal



7
drooping

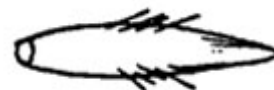


9
strongly drooping

Ad 18: Primary grain: hairiness of back of lemma (except for white and yellow oats)

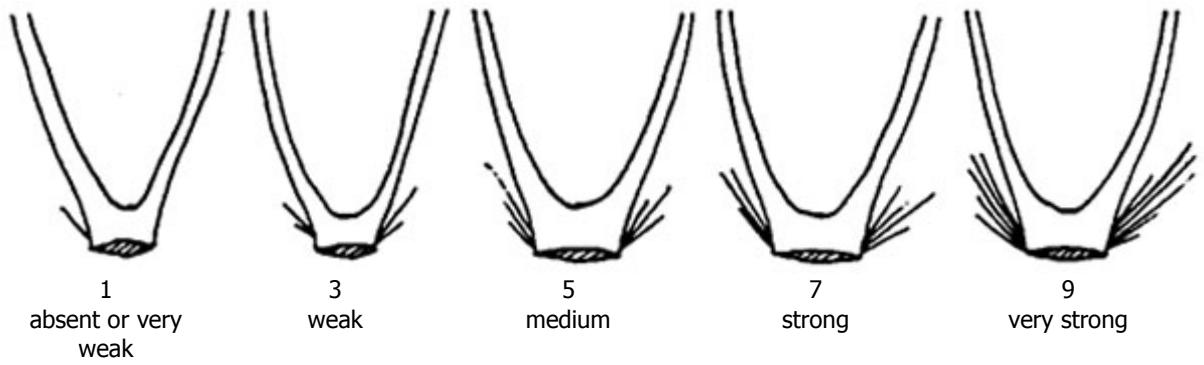


1
absent

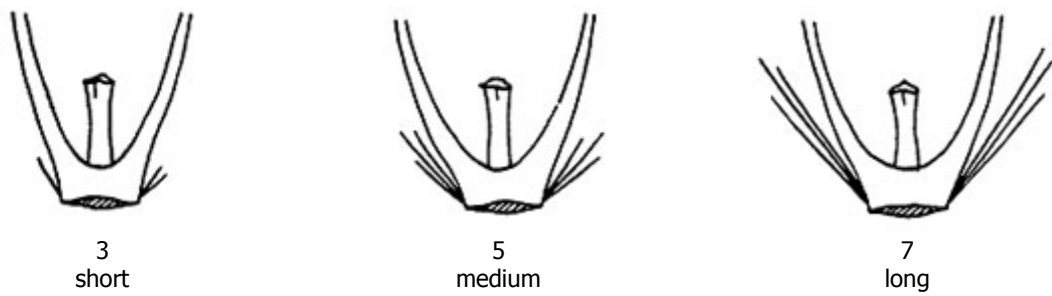


9
present

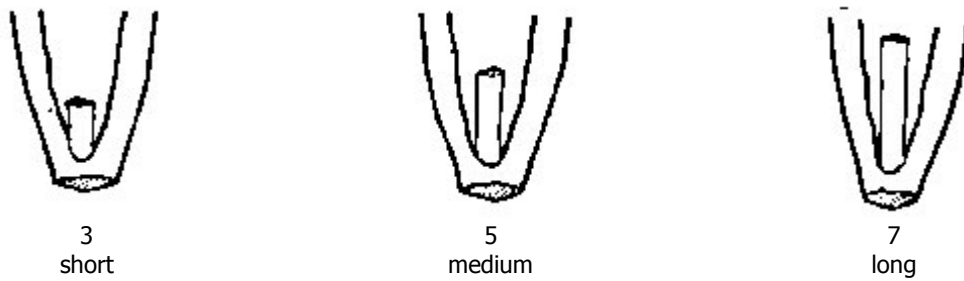
Ad 19: Primary grain: hairiness of base



Ad 20: Primary grain: length of basal hairs



Ad 21: Primary grain: length of rachilla



8.3 Growth stages

Decimal code for of the growth stages of the Zadoks decimal code for cereals (Zadok et al., 1974)

2- digit Code	General description	Feekes' Scale	Additional remarks on Wheat; Barley; Rye; Oats and Rice	
	<u>Germination</u>			
00	Dry seed			
01	Start of inhibition			
02	-			
03	Imbibition complete			
04	-			
05	Radicle emerged from caryopsis			
06	-			
07	Coleoptile emerged from caryopsis			
08	-			
09	Leaf just at coleoptile tip			
	<u>Seedling growth</u>			
10	First leaf through coleoptile	} 1 - Second leaf visible (less than 1 cm)		
11	First leaf unfolded (1)			
12	2 leaves unfolded	} 50% of laminae 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			
	<u>Tillering</u>			
20	Main shoot only	} 2	This section to be used to supplement records from other sections of the table: "Concurrent codes".	
21	Main shoot and 1 tiller			
22	Main shoot and 2 tillers	} 3		
23	Main shoot and 3 tillers			
24	Main shoot and 4 tillers			
25	Main shoot and 5 tillers			
26	Main shoot and 6 tillers			
27	Main shoot and 7 tillers			
28	Main shoot and 8 tillers			
29	Main shoot and 9 or more tillers			
	<u>Stem elongation</u>			
30	Pseudo stem erection (2)	4-5	In rice: vegetative lag phase	
31	1 st node detectable	6	} Jointing stage	
32	2 nd node detectable	7		
33	3 rd node detectable		} Above crown nodes	
34	4 th node detectable			
35	5 th node detectable			
36	6 th node detectable			
37	Flag leaf just visible	8		
38	-	-	Pre-boot stage	
			In rice: Opposite auricle	
39	Flag leaf ligule / collar just visible	9		

2- digit Code	General description	Feekes' Scale	Additional remarks on Wheat; Barley; Rye; Oats and Rice
40	<u>Booting</u> -		Little enlargement of the inflorescence; early-boot stage
41	Flag leaf sheath extending		
42	-		
43	Boots just visibly swollen		Mid-boot stage
44	-	} 10	
45	Boots swollen		Late-boot stage
46	-		
47	Flag leaf sheath opening		
48	-		
49	First awns visible		10.1 In awned forms only
	<u>Inflorescence emergence</u>		
50	First spikelet of inflorescence just visible	[N	N = non-synchronous crops
51	]	[ S	
52	]	[ N	10.2
53	]	[ S	S = synchronous crops
54	]	[ N	10.3
55	]	[ S	
56	]	[ N	10.4
57	]	[ S	
58	]	[ N	10.5
59	]	[ S	
	<u>Anthesis</u>		
60	]	[ N	10.51
61	]	[ S	Not easily detectable in barley. In rice: usually immediately following heading
62	-		
63	-		
64	]	[ N	10.52
65	]	[ S	
66	-		
67	-		
68	]	[ N	10.53
69	]	[ S	
	<u>Milk development</u>		
70	-		
71	Caryopsis watery ripe		10.54
72	-		Increase in solids of liquid endosperm notable when crushing the caryopsis between fingers
73	Early milk		
74	-		
75	medium milk		11.1
76	-		
77	Late milk		
78	-		
79	-		

2- digit Code	General description	Feekes' Scale	Additional remarks on Wheat; Barley; Rye; Oats and Rice
	<u>Dough development</u>		
80	-		
81	-		
82	-		
83	Early dough	}	11.2
84	-		
85	Soft dough		
86	-		
87	Hard dough		
88	-		
89	-		
	<u>Ripening</u>		
90	-		In rice: terminal spikelets ripened.
91	Caryopsis hard (difficult to divide by thumb-nail) (3)	11.3	
92	Caryopsis hard (can no longer be dented by thumb-nail) (4)	11.4	In rice: 50% of spikelets ripened
93	Caryopsis loosening in daytime		In rice: over 90% of spikelets ripened (5)
94	Over-ripe; straw dead and collapsing		
95	Seed dormant		Risk of grain loss by shedding
96	Viable seed giving 50% germination		
97	Seed not dormant		
98	Secondary dormancy induced		
99	Secondary dormancy lost		
	<u>Transplanting and recovery (rice only)</u>		
T1	Uprooting of seedlings		
T2	-		
T3	Rooting		
T4	-		
T5	-		
T6	-		
T7	Recovery of shoots		
T8	-		
T9	Resumption of vegetative growth		

Notes on the Table of the Decimal Code for the Growth Stages or Cereals

- (1) Stage of seedling inoculation with rust in the greenhouse.
- (2) Only applicable to cereals with a prostrate or semi-prostrate early growth habit.
- (3) Ripeness for binder (ca. 16% water content). Chlorophyll of inflorescence largely lost.
- (4) Ripeness for combine harvester (less than 16% water content).
- (5) Optimum harvest time.

9. LITERATURE

Zadoks, J.C., Chang, T.T., Konzak, C.F., 1974: A Decimal code for the Growth Stages of Cereals. Weed Research. NL, 14: 415-421

10. TECHNICAL QUESTIONNAIRE

The Technical Questionnaire is available on the CPVO website under the following reference:
CPVO-TQ/020/2