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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

Geneva

DRAFT

*

GRAIN AMARANTH

UPOV Code(s): AMARA

Amaranthus L.

GUIDELINES

FOR THE CONDUCT OF TESTS

FOR DISTINCTNESS, UNIFORMITY AND STABILITY

prepared by an expert from Slovakia

to be considered by the

Technical Working Party for Agricultural Crops at its fifty-fourth session,
to be held in Arusha, United Republic of Tanzania, from 2025-05-19 to 2025-05-22

Disclaimer: this document does not represent UPOV policies or guidance

Alternative Names:*

Botanical name	*English*	*French*	*German*	*Spanish*
Amaranthus L.	Grain Amaranth, Amaranth	Amarante	Amarant, Fuchsschwanz	Amaranto

The purpose of these guidelines ("Test Guidelines") is to elaborate the principles contained in the General Introduction (document TG/1/3), and its associated TGP documents, into detailed practical guidance for the harmonized examination of distinctness, uniformity and stability (DUS) and, in particular, to identify appropriate characteristics for the examination of DUS and production of harmonized variety descriptions.

ASSOCIATED DOCUMENTS

These Test Guidelines should be read in conjunction with the General Introduction and its associated TGP documents.

* These names were correct at the time of the introduction of these Test Guidelines but may be revised or updated. [Readers are advised to consult the UPOV Code, which can be found on the UPOV Website (www.upov.int), for the latest information.]

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1. Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Amaranthus* L. and its hybrids, excluding ornamental varieties.

2. Material Required

2.1 The competent authorities decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered. Applicants submitting material from a State other than that in which the testing takes place must ensure that all customs formalities and phytosanitary requirements are complied with.

2.2 The material is to be supplied in the form of seed.

2.3 The minimum quantity of plant material, to be supplied by the applicant, should be:

100 g of seeds

The seed should meet the minimum requirements for germination, species and analytical purity, health and moisture content, specified by the competent authority. In cases where the seed is to be stored, the germination capacity should be as high as possible and should, be stated by the applicant.

2.4 The plant material supplied should be visibly healthy, not lacking in vigor, nor affected by any important pest or disease.

2.5 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.

3. Method of Examination

3.1 Number of Growing Cycles

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

3.1.2 The two independent growing cycles should be in the form of two separate plantings.

3.1.3 The testing of a variety may be concluded when the competent authority can determine with certainty the outcome of the test.

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”.

3.3 Conditions for Conducting the Examination

3.3.1 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.

3.3.2 The optimum stage of development for the assessment of each characteristic is indicated by a number in the Table of Characteristics. The stages of development denoted by each number are described in Chapter 8.

3.4 Test Design

3.4.1 Each test should be designed to result in a total of at least 100 plants which should be divided between at least 2 replicates.

3.4.2 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

Additional tests, for examining relevant characteristics, may be established.

4. Assessment of Distinctness, Uniformity and Stability

4.1 Distinctness

4.1.1 General Recommendations

It is of particular importance for users of these Test Guidelines to consult the General Introduction prior to making decisions regarding distinctness. However, the following points are provided for elaboration or emphasis in these Test Guidelines.

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 Test Guidelines are familiar with the recommendations contained in the General Introduction prior to making decisions regarding distinctness.

4.1.4 Number of Plants or 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 of plants taken from each of 20 plants and any other observations made on all plants in the test, disregarding any off-type plants.

In the case of observations of parts taken from single plants, the number of parts to be taken from each of the plants should be 1.

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 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. color 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 these Test Guidelines to consult the General Introduction prior to making decisions regarding uniformity. However, the following points are provided for elaboration or emphasis in these Test Guidelines:

4.2.2 These Test Guidelines have been developed for the examination of seed-propagated varieties. For varieties with other types of propagation, the recommendations in the General Introduction and document TGP/13 "Guidance for new types and species" Section 4.5 "Testing Uniformity" should be followed.

4.2.3 The assessment of uniformity for should be according to the recommendations for cross-pollinated varieties in the General Introduction.

4.2.4 For the assessment of uniformity of self-pollinated varieties a population standard of 5% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 100 plants, 9 off-types are allowed.

4.3 Stability

4.3.1 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) Cotyledon: anthocyanin coloration (characteristic 1)
(b) Leaf blade: presence of blotch - to be deleted (characteristic 18)
(c) Leaf blade: shape of blotch - to be deleted (characteristic 21)
(d) Inflorescence: color (characteristic 22)
(e) Inflorescence: type (characteristic 25)
(f) Inflorescence: length of bract relative to utricle (characteristic 26)
(g) Inflorescence: growth type (characteristic 27)
(h) Stem: anthocyanin coloration of base (characteristic 32)
(i) Stem: shape in cross section (characteristic 33)
(j) Seed: color (characteristic 34)
(k) Seed: shape (characteristic 35)
(l) Seed: type (characteristic 36)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction and document TGP/9 “Examining Distinctness”.

6. Introduction to the Table of Characteristics

6.1 Categories of Characteristics

6.1.1 Standard Test Guidelines Characteristics

Standard Test Guidelines characteristics are those which are approved by UPOV for examination of DUS and from which members of the Union can select those suitable for their particular circumstances.

6.1.2 Asterisked Characteristics

Asterisked characteristics (denoted by *) are those included in the Test Guidelines which are important for the international harmonization of variety descriptions and should always be examined for DUS and included in the variety description by all members of the Union, except when the state of expression of a preceding characteristic or regional environmental conditions render this inappropriate.

6.2 States of Expression and Corresponding Notes

6.2.1 States of expression are given for each characteristic to define the characteristic and to harmonize descriptions. Each state of expression is allocated a corresponding numerical note for ease of recording of data and for the production and exchange of the description.

6.2.2 All relevant states of expression are presented in the characteristic.

6.2.3 Further explanation of the presentation of states of expression and notes is provided in document TGP/7 “Development of Test Guidelines”.

6.3 Types of Expression

An explanation of the types of expression of characteristics (qualitative, quantitative and pseudo-qualitative) is provided in the General Introduction.

6.4 Example Varieties

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

6.5 Legend

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1	**2**	**3**	**4**	**5**	**6**	**7**			
		Name of characteristics in English		**Nom du caractère en français**		**Name des Merkmals auf Deutsch**	**Nombre del carácter en español**		
		states of expression		types d'expression		Ausprägungsstufen	tipos de expresión		

1 Characteristic number

2 (*) Asterisked characteristic – see Chapter 6.1.2

3 Type of expression
QL Qualitative characteristic – see Chapter 6.3
QN Quantitative characteristic – see Chapter 6.3
PQ Pseudo-qualitative characteristic – see Chapter 6.3

4 Method of observation (and type of plot, if applicable)
MG, MS, VG, VS – see Chapter 4.1.5

5 (+) See Explanations on the Table of Characteristics in Chapter 8.2

6 (a)-(x) See Explanations on the Table of Characteristics in Chapter 8.1

7 Growth stage key (if applicable) See Explanations on the Table of Characteristics in Chapter 8.3

7. Table of Characteristics/Tableau des caracteres/Merkmalstabelle/Tabla de caracteres

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
1.	**(*)**	**QL**	**VG**			**10**			
		Cotyledon: anthocyanin coloration							
		absent						Revancha, UNIFI6161	1
		present						Amapop, Nutrisol, Rojita	9
2.		**QN**	**VG**			**10**			
		Hypocotyl: intensity of anthocyanin coloration							
		absent or very weak						UNIFI6161	1
		very weak to weak							2
		weak						Pribina, Rojita	3
		weak to medium							4
		medium						Zobor	5
		medium to strong							6
		strong						Amapop, Nutrisol	7
		strong to very strong							8
		very strong							9
3.		**QN**	**MS**		**(a)**	**13**			
		Leaf: length							
		very short							1
		very short to short							2
		short						Mariel	3
		short to medium							4
		medium						Amapop, Rojita	5
		medium to long							6
		long						Nutrisol	7
		long to very long							8
		very long							9

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
4.		**QN**	**MS**		**(a)**	**13**			
		Leaf: width							
		very narrow							1
		very narrow to narrow							2
		narrow						Mariel	3
		narrow to medium							4
		medium						Amapop, Nutrisol, Rojita	5
		medium to broad							6
		broad							7
		broad to very broad							8
		very broad							9
5.		**QN**	**MS/VG**		**(a)**	**13**			
		Leaf: ratio length/width							
		very low							1
		very low to low							2
		low						Revancha	3
		low to medium							4
		medium						Amapop	5
		medium to high							6
		high						Pribina	7
		high to very high							8
		very high							9
6.		**QN**	**VG**	**(+)**	**(a)**	**13**			
		Leaf: position of broadest part							
		in middle or slightly towards base						Aztek	1
		moderately towards base						Pribina	2
		strongly towards base						Rojita	3
7.		**QN**	**VG**		**(a)**	**13**			
		Leaf: prominence of veins							
		weak						Rojita, Zobor	1
		medium						Pribina	2
		strong						Nutrisol, Revancha	3

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
8.		**PQ**	**VG**		**(a)**	**13**			
		Leaf: main color on upper side							
		light green						Revancha, Zobor	1
		medium green						Rojita, UNIFI6161	2
		dark green							3
		red						Nutrisol	4
		purple						Amapop	5
9.		**PQ**	**VG**	**(+)**	**(a)**	**13**			
		Leaf: distribution of secondary color on upper side							
		at basal part						Pribina, Rojita	1
		central blotch						Zobor	2
		at margin and veins						UNIFI6161	3
10.		**PQ**	**VG**		**(a)**	**13**			
		Leaf: color on lower side							
		green						Pribina	1
		green purple						Aztek, Zobor	2
		red						Nutrisol	3
		purple						Amapop	4
11.		**QN**	**MG/MS**	**(+)**					
		Time of beginning of inflorescence emergence							
		very early							1
		very early to early							2
		early							3
		early to medium							4
		medium						Pribina, UNIFI6161	5
		medium to late							6
		late						Nutrisol	7
		late to very late							8
		very late							9

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
12.		**QN**	**MG**	**(+)**					
		Time of flowering							
		very early							1
		very early to early							2
		early							3
		early to medium							4
		medium						Amapop, Pribina	5
		medium to late							6
		late						Nutrisol, Zobor	7
		late to very late							8
		very late							9
13.		**PQ**	**VG**			**65**			
		Stem: color							
		green						Pribina, Revancha	1
		yellow						Mariel	2
		pink							3
		red						Nutrisol	4
		purple						Amapop	5
14.	**(*)**	**QL**	**VG**			**65**			
		Stem: presence of stripes							
		absent						Pribina, UNIFI6161	1
		present						Amapop	9
15.		**PQ**	**VG**			**65**			
		Stem: color of stripes							
		red							1
		red purple						UNIFI6161	2
		purple						Amapop	3

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
16.		**QN**	**VG**		**(a)**	**65**			
		Leaf petiole: intensity of anthocyanin coloration							
		absent or very weak						Revancha, Rojita	1
		very weak to weak							2
		weak						Oeschberg	3
		weak to medium							4
		medium						UNIFI6161	5
		medium to strong							6
		strong						Amapop	7
		strong to very strong							8
		very strong						Nutrisol	9
17.		**PQ**	**VG**		**(a)**	**65**			
		Leaf blade: main color							
		light green						Revancha	1
		medium green						Pribina, Rojita	2
		dark green						Oeschberg	3
		red						Amapop, Gabriela	4
18.	**(*)**	**QL**	**VG**	**(+)**	**(a)**	**65**			
		Leaf blade: presence of blotch - to be deleted							
		absent						Pribina, Revancha	1
		present						Amapop	9

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
19.		**QN**	**VG**	**(+)**	**(a)**	**65**			
		Only for varieties with distribution of secondary color on upper side: central blotch: Leaf blade: size of blotch in relation to blade							
		very small							1
		very small to small							2
		small							3
		small to medium							4
		medium						Aztek	5
		medium to large							6
		large						Amapop	7
		large to very large							8
		very large							9
20.		**PQ**	**VG**		**(a)**	**65**			
		Only for varieties with distribution of secondary color on upper side: central blotch: Leaf blade: color of blotch							
		green						Amapop	1
		grey							2
		purple						Aztek, Gabriela	3
21.	**(*)**	**QL**	**VG**	**(+)**	**(a)**	**65**			
		Leaf blade: shape of blotch - to be deleted							
		ovoid						Amapop	1
		“V” shaped							2

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
22.	**(*)**	**PQ**	**VG**			**65**			
		Inflorescence: color							
		yellow						Mariel	1
		green						Revancha	2
		green purple						Pribina	3
		pink						Aztek	4
		red						Rojita, UNIFI6161	5
		purple						Amapop, Nutrisol	6
		brown							7
23.		**QN**	**VG**	**(+)**		**65**			
		Inflorescence: attitude of lateral branches							
		upright						Nutrisol, Rojita	1
		semi-upright						Revancha, UNIFI6161	2
		spreading						Oeschberg, Zobor	3
24.		**QN**	**VG**	**(+)**		**65**			
		Inflorescence: density of glomerules							
		very sparse							1
		very sparse to sparse							2
		sparse						Oeschberg	3
		sparse to medium							4
		medium						Amapop, Nutrisol	5
		medium to dense							6
		dense							7
		dense to very dense							8
		very dense							9
25.	**(*)**	**QL**	**VG**	**(+)**		**65**			
		Inflorescence: type							
		amarantiform						Nutrisol, Pribina	1
		glomerulate						Revancha, Zobor	2

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
26.	**(*)**	**QN**	**VG**	**(+)**		**65**			
		Inflorescence: length of bract relative to utricle							
		shorter						Amapop, Pribina	1
		equal						Revancha, UNIFI6161	2
		longer						Nutrisol, Oeschberg	3
27.	**(*)**	**QL**	**VG**	**(+)**		**65**			
		Inflorescence: growth type							
		determinate						Pribina, Revancha	1
		indeterminate						Amapop, Nutrisol	2
28.		**QN**	**VG**	**(+)**		**65**			
		Inflorescence: attitude							
		upright or weakly recurved						Nutrisol, Pribina	1
		moderately recurved						Amapop	2
		strongly recurved							3
29.		**QN**	**MS/VG**	**(+)**		**65**			
		Inflorescence: length							
		very short							1
		very short to short							2
		short							3
		short to medium							4
		medium						Pribina, Revancha	5
		medium to long							6
		long						Nutrisol	7
		long to very long							8
		very long							9

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
30.		**QN**	**MG/MS**	**(+)**		**89**			
		Plant: time of maturity							
		very early							1
		very early to early							2
		early							3
		early to medium							4
		medium						Pribina, Revancha	5
		medium to late							6
		late						Nutrisol, Zobor	7
		late to very late							8
		very late							9
31.		**QN**	**MG/MS**	**(+)**		**89**			
		Plant: length							
		very low						Zobor	1
		very low to low							2
		low							3
		low to medium							4
		medium						Revancha	5
		medium to long						Pribina	6
		long						Nutrisol	7
		long to very long							8
		very long							9
32.	**(*)**	**QL**	**VG**			**89**			
		Stem: anthocyanin coloration of base							
		absent						Pribina, Revancha	1
		present						Amapop, Nutrisol	9
33.	**(*)**	**QL**	**VG**	**(+)**		**89**			
		Stem: shape in cross section							
		circular							1
		undulated						Revancha	2

		English		français		deutsch	español	Example Varieties Exemples Beispielssorten Variedades ejemplo	Note/ Nota
34.	**(*)**	**PQ**	**VG**			**89**			
		Seed: color							
		white						Amapop, Revancha	1
		yellow							2
		pink							3
		brown						Oeschberg	4
		black							5
35.	**(*)**	**QL**	**VG**	**(+)**		**89**			
		Seed: shape							
		ellipsoid						Nutrisol, Revancha	1
		discoid						Amapop, Pribina, Rojita	2
36.	**(*)**	**QL**	**VG**			**89**			
		Seed: type							
		flint						Nutrisol, Rojita	1
		floury						Amapop, Pribina, Revancha	2
37.		**QN**	**MG**	**(+)**		**89**			
		Seed: weight per 1000 seeds							
		very low							1
		very low to low							2
		low							3
		low to medium						Oeschberg	4
		medium							5
		medium to high						Amapop	6
		high							7
		high to very high						Pribina	8
		very high							9

8. Explanations on the Table of Characteristics

8.1 Explanations covering several characteristics

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

(a) Observation should be made on leaves in the middle part of plants.

8.2 Explanations for individual characteristics

Ad. 6: Leaf: position of broadest part

1
in middle or slightly towards base

2
moderately towards base

3
strongly towards base

Ad. 9: Leaf: distribution of secondary color on upper side

1
colored basal area

2
central blotch

3
colored margin and veins

Ad. 11: Time of beginning of inflorescence emergence

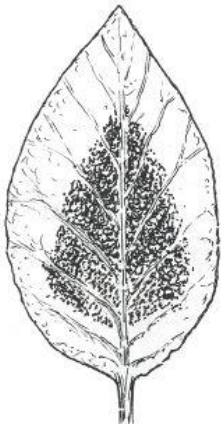
The time of beginning of inflorescence emergence is reached when 50 % of the plants have an inflorescence of at least 1 cm in length in the apex of the main stem.

Ad. 12: Time of flowering

The time of flowering is reached when 50 % of the plants have a panicle approximately 5 cm long, showing open flowers in its middle parts with separate stamens and with the stigma completely visible.

Ad. 18: Leaf blade: presence of blotch - to be deleted

1
absent



9
present

Ad. 19: Only for varieties with distribution of secondary color on upper side: central blotch: Leaf blade: size of blotch in relation to blade

3
small

5
medium

7
large

Ad. 21: Leaf blade: shape of blotch - to be deleted

1
ovoid

2
"V" shaped

Ad. 23: Inflorescence: attitude of lateral branches

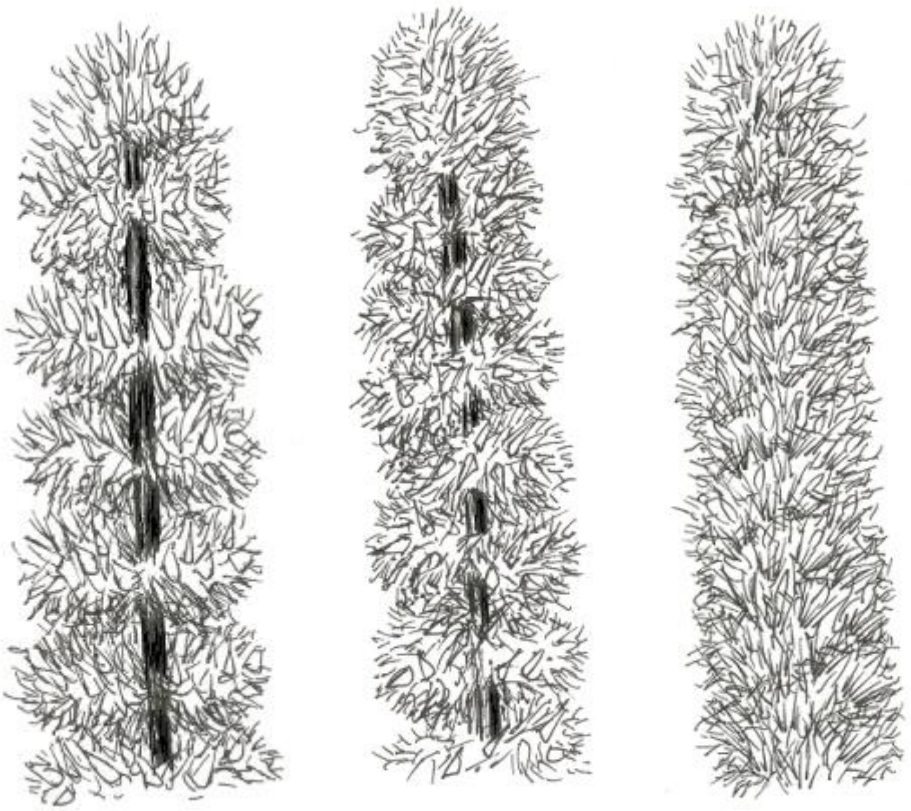
1
upright

2
semi-upright

3
spreading

Ad. 24: Inflorescence: density of glomerules

The density of glomerules should be observed on the lateral branches of the main inflorescence.

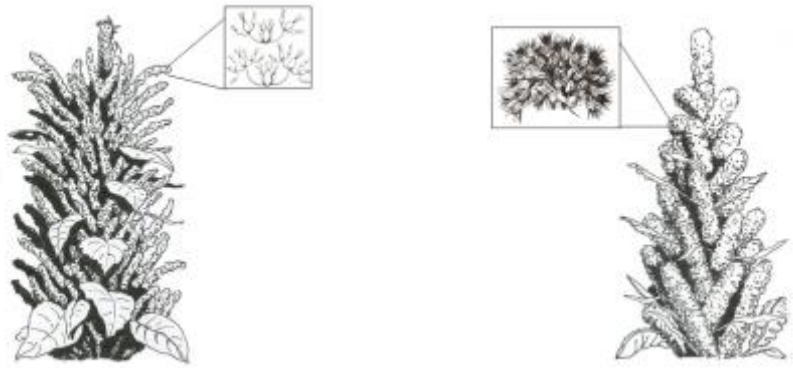


3	5	7
sparse	medium	dense

Ad. 25: Inflorescence: type

Amarantiform: if the glomerules are inserted in the secondary axes and the glomerules have an extended shape, the inflorescences are ‘amarantiform’.

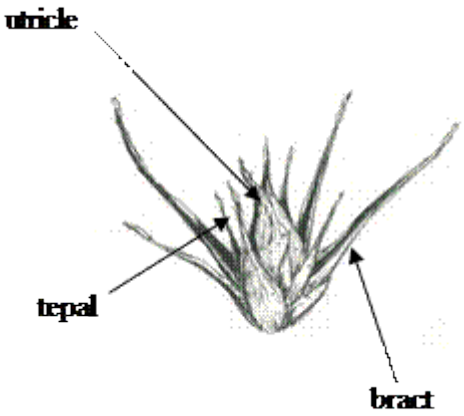
Glomerulate: if the glomerules are inserted in the primary axes and the glomerules have a spherical shape, the inflorescences are ‘glomerulate’.



1	2
amarantiform	glomerulate

Ad. 26: Inflorescence: length of bract relative to utricle

The observation should be made with a microscope.
Utricle: formed by the mature seed and the opercule (the dehiscent layer which covers the seed).
Bracts: the structures outside the tepals which protect the utricle.



1	2	3
shorter	equal	longer

a: length of utricle
b: length of bract

Ad. 27: Inflorescence: growth type

Determinate type of inflorescence: The growth of inflorescence stops with the flowering of the terminal bud.

Indeterminate type of inflorescence: The growth of inflorescence continues after beginning of flowering.

Ad. 28: Inflorescence: attitude

1	2	3
upright or weakly recurved	moderately recurved	strongly recurved

Ad. 29: Inflorescence: length

The inflorescence should be measured by stretching in horizontal position. The measurement should be taken from the base to the tip of inflorescence.

Ad. 30: Plant: time of maturity

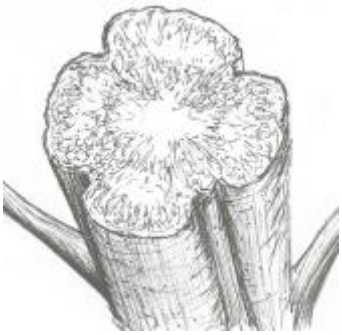
The time of plant maturity is reached when seed taken from the central part of the inflorescence does not change shape when pressed between fingers.

Ad. 31: Plant: length

The plant should be measured from the base of the plant to the tip of the inflorescence.

Ad. 33: Stem: shape in cross section

1
circular



2
undulated

Ad. 35: Seed: shape

1
ellipsoid

2
discoid

Ad. 36: Seed: type

The observation of seed should be made on the glass lid: if the light is transmitted through the seed, it is flint type seed; if the light is not transmitted, it is floury type seed.

8.3 Additional Explanations on the Table of Characteristics

Description of the phenological growth stages of *Amaranth* sp. according to the BBCH scale

Principal growth stage BBCH	BBCH Code	Description
0: Germination	00	Dry seed
	01	Beginning of seed imbibition
	03	Seed imbibition completed
	05	Radicle emerged from seed
	06	Radicle elongated, root hairs and/or side roots visible
	08	Emergence of hypocotyl
	09	Emergence of cotyledons through soil
	10	Cotyledons fully emerged/Opening of cotyledons
1: Leaf development	11	First pair of leaves visible
	12	Second pair of leaves visible
	13	Five or six leaves visible
	1...	Stages continuous till…
3: Stem elongation		The longitudinal growth of the main stem occurs in parallel with the leaf development. That is why the coding of the main stadium 3 is omitted
5: Inflorescence emergence	50	Beginning of panicle emergence (panicle still enclosed by leaves)
	51	Leaves surrounding inflorescence separated, inflorescence is visible from above
	52	Panicle visible from the sides (panicle's indeterminate growth habit)
	59	Inflorescence visible, but all flowers are still closed
6: Anthesis and axillary inflorscence	60	Beginning of anthesis: main inflorescence flowers with first extruded anthers (acropete flowering)
	63	Staminate and pistillate flowers visible
	65	Full flowering: anthers visible on most panicle
	69	End of flowering: The panicle have completed flowering, but some senesced anthers may remain
7: Fruit and seed development)	70	Ovary thickening (development of the fertilized ovule)
	71	Watery ripe: The first visible grains have reached half their final size
	73	Early milk: Immature grains (the grains show a milky consistency)
	75	Medium milk: Grains with a white coloration of opaque tone and a pasty consistency
	77	Late milk: the grain's texture is slightly rough, and their coloration becomes opaque ivory
8: Ripening Seed ripening	80	Milky grain, grain content soft but dry, easily crushed with fingernails
	85	Hard dough: Grain content solid, easily crushed with fingernails
	89	Ripe grain: difficult to crush with fingernails, dry content, the grain has an opaque ivory color on its outside. Ready to harvest.
9: Senescence	95	Panicle changes color
	97	Plant dead and collapsing

9. Literature

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10. Technical Questionnaire

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Application date: (not to be filled in by the applicant)

TECHNICAL QUESTIONNAIRE
to be completed in connection with an application for plant breeders' rights

1. Subject of the Technical Questionnaire

1.1.1	Botanical name	*Amaranthus* L.	☐
1.1.2	Common name	Grain Amaranth, Amaranth	
1.2.1	Botanical name	Amaranthus albus L.	☐
1.2.2	Common name		
1.3.1	Botanical name	Amaranthus blitoides S. Watson	☐
1.3.2	Common name		
1.4.1	Botanical name	Amaranthus caudatus L.	☐
1.4.2	Common name		
1.5.1	Botanical name	Amaranthus crispus (Lesp. et Thévenau) N Terracc.	☐
1.5.2	Common name		
1.6.1	Botanical name	Amaranthus cruentus L.	☐
1.6.2	Common name		
1.7.1	Botanical name	Amaranthus dubius Mart. ex Thell.	☐
1.7.2	Common name		
1.8.1	Botanical name	Amaranthus graecizans L.	☐
1.8.2	Common name		

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

1.9.1	Botanical name	Amaranthus hypocondriacus L. × Amaranthus cruentus L.	☐
1.9.2	Common name		
1.10.1	Botanical name	Amaranthus hybridus L. × Amaranthus hypochondriacus L.	☐
1.10.2	Common name		
1.11.1	Botanical name	Amaranthus hybridus L.	☐
1.11.2	Common name		
1.12.1	Botanical name	Amaranthus hypochondriacus L.	☐
1.12.2	Common name		
1.13.1	Botanical name	Amaranthus retroflexus L.	☐
1.13.2	Common name		
1.14.1	Botanical name	Amaranthus spinosus L.	☐
1.14.2	Common name		
1.15.1	Botanical name	Amaranthus thunbergii Moq.	☐
1.15.2	Common name		
1.16.1	Botanical name	Amaranthus tricolor L.	☐
1.16.2	Common name		
1.17.1	Botanical name	Amaranthus viridis L.	☐
1.17.2	Common name		

2. Applicant

Name	
Address	
Telephone No.	
Fax No.	

E-mail address	
Breeder (if different from applicant)	

3. Proposed denomination and breeder's reference

Proposed denomination (if available)	
Breeder's reference	

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

#4. Information on the breeding scheme and propagation of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

(a) controlled cross [ ]

(please state parent variety)

(……..……..…) x (……..……..…)

female parent male parent

(b) partially known cross [ ]

(please state parent variety(ies))

(……..……..…) x (……..……..…)

female parent male parent

(c) unknown cross [ ]

4.1.2 Mutation
(please state parent variety)

4.1.3 Discovery and development
(please state where and when discovered and how developed)

4.1.4 Other
(Please provide details)

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

4.2 Method of propagating the variety

4.2.1 Seed-propagated varieties

(a) Self-pollination	[ ]
(b) Cross-pollination	[ ]
(i) Population	[ ]
(ii) Synthetic variety	[ ]
(c) Hybrid	[ ]
(d) Other (please provide details)	[ ]

4.2.2 Vegetative propagation

(a) Other (state method) [ ]

4.2.3 Other
(Please provide details) [ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in Test Guidelines; please mark the note which best corresponds).

	Characteristics	Example Varieties	Note
5.1 (1)	**Cotyledon: anthocyanin coloration**		
	absent	Revancha, UNIFI6161	1 [ ]
	present	Amapop, Nutrisol, Rojita	9 [ ]
5.2 (18)	**Leaf blade: presence of blotch - to be deleted**		
	absent	Pribina, Revancha	1 [ ]
	present	Amapop	9 [ ]
5.3 (21)	**Leaf blade: shape of blotch - to be deleted**		
	ovoid	Amapop	1 [ ]
	“V” shaped		2 [ ]
5.4 (22)	**Inflorescence: color**		
	yellow	Mariel	1 [ ]
	green	Revancha	2 [ ]
	green purple	Pribina	3 [ ]
	pink	Aztek	4 [ ]
	red	Rojita, UNIFI6161	5 [ ]
	purple	Amapop, Nutrisol	6 [ ]
	brown		7 [ ]
5.5 (25)	**Inflorescence: type**		
	amarantiform	Nutrisol, Pribina	1 [ ]
	glomerulate	Revancha, Zobor	2 [ ]
5.6 (26)	**Inflorescence: length of bract relative to utricle**		
	shorter	Amapop, Pribina	1 [ ]
	equal	Revancha, UNIFI6161	2 [ ]
	longer	Nutrisol, Oeschberg	3 [ ]
5.7 (27)	**Inflorescence: growth type**		
	determinate	Pribina, Revancha	1 [ ]
	indeterminate	Amapop, Nutrisol	2 [ ]
5.8 (32)	**Stem: anthocyanin coloration of base**		
	absent	Pribina, Revancha	1 [ ]
	present	Amapop, Nutrisol	9 [ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

	Characteristics	Example Varieties	Note
5.9 (33)	**Stem: shape in cross section**		
	circular		1 [ ]
	undulated	Revancha	2 [ ]
5.10 (34)	**Seed: color**		
	white	Amapop, Revancha	1 [ ]
	yellow		2 [ ]
	pink		3 [ ]
	brown	Oeschberg	4 [ ]
	black		5 [ ]
5.11 (35)	**Seed: shape**		
	ellipsoid	Nutrisol, Revancha	1 [ ]
	discoid	Amapop, Pribina, Rojita	2 [ ]
5.12 (36)	**Seed: type**		
	flint	Nutrisol, Rojita	1 [ ]
	floury	Amapop, Pribina, Revancha	2 [ ]

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

6. Similar varieties and differences from these varieties

Please use the following table and box for comments to provide information on how your candidate variety differs from the variety (or varieties) which, to the best of your knowledge, is (or are) most similar. This information may help the examination authority to conduct its examination of distinctness in a more efficient way.

Denomination(s) of variety(ies) similar to your candidate variety	Characteristic(s) in which your candidate variety differs from the similar variety(ies)	Describe the expression of the characteristic(s) for the **similar** variety(ies)	Describe the expression of the characteristic(s) for **your** candidate variety
Example	*Inflorescence: type*	*amarantiform*	*glomerulate*

Comments

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

#7. Additional information which may help in the examination of the variety

7.1 In addition to the information provided in sections 5 and 6, are there any additional characteristics which may help to distinguish the variety?

Yes [ ] No [ ]

(If yes, please provide details)

7.2 Are there any special conditions for growing the variety or conducting the examination?

Yes [ ] No [ ]

(If yes, please provide details)

7.3 Other information

Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire.

TECHNICAL QUESTIONNAIRE	Page {x} of {y}	Reference Number:

8. Authorization for release

(a) Does the variety require prior authorization for release under legislation concerning the protection of the environment, human and animal health?

Yes [ ] No [ ]

(b) Has such authorization been obtained?

Yes [ ] No [ ]

If the answer to (b) is yes, please attach a copy of the authorization.

9. Information on plant material to be examined or submitted for examination

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 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 the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a) Microorganisms (e.g. virus, bacteria, phytoplasma) Yes [ ] No [ ]

(b) Chemical treatment (e.g. growth retardant, pesticide) Yes [ ] No [ ]

(c) Tissue culture Yes [ ] No [ ]

(d) Other factors Yes [ ] No [ ]

Please provide details for where you have indicated “yes”.

_____

9.3 Has the plant material to be examined been tested for the presence of virus or other pathogens?

Yes [ ]

(please provide details as specified by the Authority)

No [ ]

10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:

Applicant’s name

Signature Date

[End of document]