

UPOV

TG/AMARAN(proj.6)

ORIGINAL: English

DATE: 2007-03-01

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS
GENEVA

DRAFT**GRAIN AMARANTH**

UPOV code: AMARA

(Amaranthus L.
excluding ornamental varieties)

GUIDELINES**FOR THE CONDUCT OF TESTS****FOR DISTINCTNESS, UNIFORMITY AND STABILITY**

prepared by experts from Mexico

*to be considered by the Technical Committee at its forty-third session,
to be held in Geneva, Switzerland, from March 26 to 28, 2007*

Alternative Names:*

<i>Botanical name</i>	<i>English</i>	<i>French</i>	<i>German</i>	<i>Spanish</i>
<i>Amaranthus L.</i>	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.]

<u>TABLE OF CONTENTS</u>	<u>PAGE</u>
1. SUBJECT OF THESE TEST GUIDELINES.....	3
2. MATERIAL REQUIRED	3
3. METHOD OF EXAMINATION.....	3
3.1 Testing Place.....	4
3.2 Conditions for Conducting the Examination	4
3.3 Test Design	4
3.4 Number of Plants / Parts of Plants to be Examined	4
3.5 Additional Tests	4
4. ASSESSMENT OF DISTINCTNESS, UNIFORMITY AND STABILITY	5
4.1 Distinctness.....	5
4.2 Uniformity	5
4.3 Stability.....	5
5. GROUPING OF VARIETIES AND ORGANIZATION OF THE GROWING TRIAL.....	6
6. INTRODUCTION TO THE TABLE OF CHARACTERISTICS	6
6.1 Categories of Characteristics	6
6.2 States of Expression and Corresponding Notes	7
6.3 Types of Expression.....	7
6.4 Example Varieties.....	7
6.5 Legend	7
7. TABLE OF CHARACTERISTICS/TABLEAU DES CARACTÈRES/MERKMALSTABELLE/TABLA DE CARACTERES.....	8
8. EXPLANATIONS ON THE TABLE OF CHARACTERISTICS	17
8.1 Explanations covering several characteristics.....	17
8.2 Explanations for individual characteristics	17
9. LITERATURE.....	27
10. TECHNICAL QUESTIONNAIRE.....	29

1. Subject of these Test Guidelines

1.1 These Test Guidelines apply to all varieties of *Amaranthus* L. excluding ornamental varieties.

1.2 The main grain species are *Amaranthus hypochondriacus*, *Amaranthus cruentus* and *Amaranthus caudatus*. The main ornamental species are *Amaranthus tricolor* L. (synonymous with *Amaranthus gangeticus* L., *Amaranthus tristis* L., *Amaranthus mangostanus* L. and *Amaranthus melancholicus* L.,) and *Amaranthus caudatus* L. (synonymous with *Amaranthus edulis* Spegazzini, *Amaranthus mantegazzianus* Passerini). These species are identified as ornamentals for cultivation in gardens as they have attractive foliage. *Amaranthus caudatus* L. is also used for the production of seed or grain and is grown in Argentina, Bolivia, Ecuador and Peru.

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

2.4 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.

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

2.6 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*

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”.

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 Type of observation

The recommended method of observing the characteristics is indicated by the following key in the second column of the Table 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.

3.4 *Test Design*

3.4.1 In the case of inbred lines, each test should be designed to result in a total of at least 50 plants, which should be divided between two or more replicates.

3.4.2 In the case of cross-pollinated varieties, each test should be designed to result in a total of at least 150 plants, which should be divided between two or more replicates.

3.4.3 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 *Number of Plants / Parts of Plants to be Examined*

Unless otherwise indicated, all observations on single plants should be made on 20 plants or parts taken from each of 20 plants.

3.6 *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.

4.2 *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 For the assessment of uniformity of inbred lines, a population standard of 1% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 50 plants, two off-types are allowed.

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

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.

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 is 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) Seedling: anthocyanin coloration of hypocotyls (characteristic 2)
- (c) Petiole: anthocyanin coloration (characteristic 18)
- (d) Leaf blade: presence of blotch (characteristic 20)
- (e) Leaf blade: shape distribution of blotch (characteristic 23)
- (f) Inflorescence: color (characteristic 24)
- (g) Inflorescence: type (characteristic 27)
- (h) Inflorescence: size of bract relative to utricle (characteristic 29)
- (i) Inflorescence: growth type (characteristic 30)
- (j) Stem: anthocyanin coloration of base (at maturity) (characteristic 35)
- (k) Stem: shape in cross section (at maturity) (characteristic 36)
- (l) Seed: color (characteristic 37)
- (m) Seed: shape (characteristic 38)
- (n) Seed: type (characteristic 39)

5.4 Guidance for the use of grouping characteristics, in the process of examining distinctness, is provided through the General Introduction.

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*

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.

6.3 *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*

(*) Asterisked characteristic – see Chapter 6.1.2

QL: Qualitative characteristic – see Chapter 6.3

QN: Quantitative characteristic – see Chapter 6.3

PQ: Pseudo-qualitative characteristic – see Chapter 6.3

MG, MS, VG, VS: See Chapter 3.3.2

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

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

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

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
1. (*)	VG Cotyledon: anthocyanin coloration	Cotylédon : pigmentation anthocyanique	Keimblatt: Anthocyan-färbung	Cotiledones: pigmentación antociánica		
QL (a)	absent	absente	fehlend	ausente	Eniko, Maros, Revancha	1
	present	présente	vorhanden	presente	Edit, Nutrisol, Reka, Rojita	9
2. (*)	VG Seedling: anthocyanin coloration of hypocotyls	Plantule : pigmentation anthocyanique des hypocotyles	Keimpflanze: Anthocyan-färbung des Keimblattes	Plántula: Pigmentación antociánica del hipocótilo		
QL (a)	absent	absente	fehlend	ausente	Amarilla	1
	present	présente	vorhanden	presente	Edit, Nutrisol, Rojita	9
3.	VG Seedling: intensity of anthocyanin pigmentation of hypocotyls	Plantule : intensité de la pigmentation anthocyanique des hypocotyles	Keimpflanze: Intensität der Anthocyan-färbung des Keimblattes	Plántula: intensidad de la pigmentación antociánica del hipocotilo		
QN (a)	weak	faible	gering	débil	Rojita	3
	medium	moyenne	mittel	media	Edit	5
	strong	forte	stark	fuerte	Edit, Nutrisol, Reka	7
4.	MS Young leaf: length	Jeune feuille : longueur	Junges Blatt: Länge	Hoja joven: longitud		3
QN (b)	short	courte	kurz	corta	Amarilla	3
	medium	moyenne	mittel	mediana	Rojita	5
	long	longue	lang	larga	Nutrisol	7
5.	MS Young leaf: width	Jeune feuille : largeur	Junges Blatt: Breite	Hoja joven: anchura		
QN (b)	narrow	étroite	schmal	estrecha	Amarilla, Reka	3
	medium	moyenne	mittel	mediana	Nutrisol, Rojita	5
	broad	large	breit	ancha	Roja Tulyehualco	7

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
6.	VG	Young leaf: ratio length/width	Jeune feuille : rapport largeur/longueur	Junges Blatt: Verhältnis Breite/Länge	Hoja joven: relación anchura/longitud	
PQ	(b)	small	petit	klein	pequeña	Revancha 3
		medium	moyen	mittel	media	Reka 5
		large	grand	groß	grande	Muestra Tulyehualco 7
7.	VG	Young leaf: position of widest point	Jeune feuille : position de la partie la plus large	Junges Blatt: Position des breitesten Teils	Hoja joven: posición de la parte más ancha	
(+)						
QL	(b)	towards base	vers la base	zur Basis hin	hacia la base	Edit, Rojita, Roza 1
		in the middle	au milieu	in der Mitte	en la mitad	Amarilla 2
8.	VG	Young leaf: prominence of veins	Jeune feuille : proéminence des nervures	Junges Blatt: Ausprägung der Adern	Hoja joven: prominencia de nervaduras	
QN	(b)	weak	faible	gering	débil	Rojita 1
		strong	forte	stark	fuerte	Nutrisol, Revancha 2
9.	VG	Young leaf: main color on upper side	Jeune feuille : couleur principale de la face supérieure	Junges Blatt: Hauptfarbe an der Oberseite	Hoja joven: color principal del haz	
PQ	(b)	light green	vert clair	hellgrün	verde claro	Reka, Revancha 1
		medium green	vert moyen	mittelgrün	verde medio	Rojita 2
		dark green	vert foncé	dunkelgrün	verde oscuro	Nativa Tulyehualco 3
		red	rouge	rot	rojo	Nutrisol 4
		purple	pourpre	purpurn	purpura	ITAX 0092 5

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota	
10.	VG	Young leaf: distribution of pigmentation of color at beginning of growth on upper side	Jeune feuille : distribution de la pigmentation au début de la croissance sur la face supérieure	Junges Blatt: Verteilung der Farb-pigmentierung an der Oberseite zu Beginn des Wachstums	Hoja joven: distribución de la pigmentación al inicio del crecimiento en el haz		
(+)							
PQ	(b)	colored basal area	surface de la base colorée	gefärbte Basalzone	área basal pigmentada	Rojita	1
		central blotch	tache centrale	zentraler Fleck	mancha central	Edit	2
		one “V” shaped stripe	une bande en “V”	ein V-förmiger Streifen	una franja en forma de “V”	Nativa Tulyehualco	3
		two “V” shaped stripes	deux bandes en “V”	zwei V-förmige Streifen	dos franjas en forma de “V”	Mixteco	4
		colored margin and veins	coloration sur le bord et les nervures	gefärbt am Rand und an den Adern	margen y venas pigmentadas	Reka	5
		in a strip	en bande	in Streifen	En una franja	ITAX0092	6
11.	VG	Young leaf: color on the lower side	Jeune feuille : couleur de la face inférieure	Junges Blatt: Farbe an der Unterseite	Hoja joven: color del envés		
PQ	(b)	green	verte	grün	verde	Reka	1
		red	rouge	rot	rojo	Nutrisol	2
		purple	pourpre	purpurn	púrpura	ITAX0092	3
12.	VG	Leaf: type of margin	Feuille : type de bord	Blatt: Typ des Randes	Hoja: tipo del margen		
(+)							
PQ	(c)	entire	entier	ganzrandig	entero	Edit, Rojita, Roza	1
		sinuate	sinué	gebuchtet	sinuoso	Revancha	2
13.	VS	Plant: time of beginning of emergence of inflorescence	Plante : époque de début de l'épiaison	Pflanze: Zeitpunkt des Erscheinens der Blütenstände	Planta: época de aparición de inflorescencia		
QN	(d)	early	précoce	früh	precoz	Edit	3
		medium	moyenne	mittel	media	Maros, Reka, Roza	5
		late	tardive	spät	tardía	Nutrisol	7

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota	
14.	MG	Inflorescence: time of flowering	Inflorescence : époque de floraison	Blütenstand: Zeitpunkt der Blüte	Inflorescencia: época de floración		
(+)							
QN	(e)	early	précoce	früh	precoz	Edit	3
		medium	moyenne	mittel	media	Maros, Reka, Roza	5
		late	tardive	spät	tardía	Nutrisol	7
15.	VG	Stem: color (at anthesis)	Tige : couleur (à la floraison)	Stengel: Farbe (im Stadium der Blüte)	Tallo: color (en anthesis)		
PQ	(e)	green	verte	grün	verde	Edit, Eniko, Maros, Reka, Revancha	1
		yellow	jaune	gelb	amarillo	Amarilla	2
		pink	rose	rosa	rosa	Roza	3
		red	rouge	rot	rojo	Nutrisol	4
		purple	pourpre	purpurn	púrpura	ITAX 00092	5
16.	VG	Stem: color of stripes	Tige : couleur des bandes	Stengel: Farbe der Streifen	Tallo: color de las rayas		
QL	(e)	red	rouges	rot	rojo	Roja Tulyehualco	1
		purple	pourpres	purpurn	púrpura	BRS_ALEGRÍA	2
17.	VG	Leaf blade: main color	Limbe : couleur principale	Blattspreite: Hauptfarbe	Limbo: color principal		
PQ	(e)	light green	vert clair	hellgrün	verde claro	Maros, Revancha	1
		medium green	vert moyen	mittelgrün	verde medio	Rojita, Roza	2
		dark green	vert foncé	dunkelgrün	verde oscuro	Edit	3
		red	rouge	rot	rojo	L2ITAX	4
18.	VG	Petiole: anthocyanin coloration	Pétiole : pigmentation anthocyanique	Blattstiel: Anthocyanfärbung	Pecíolo: pigmentación antocianica		
QL	(e)	absent	absente	fehlend	ausente	Edit, Revancha, Rojita	1
		present	présente	vorhanden	presente	Nutrisol, Reka, Roza	9

		English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
19.	VG	Petiole: intensity of anthocyanin coloration	Pétiole : intensité de la pigmentation anthocyanique	Blattstiel; Intensität der Anthocyanfärbung	Pecíolo: intensidad de la pigmentación antocíánica		
QN	(e)	very weak	très faible	sehr gering	muy débil		1
		weak	faible	gering	débil		3
		medium	moyenne	mittel	media	Reka	5
		strong	forte	stark	fuerte	Roza	7
		very strong	très forte	sehr stark	muy fuerte	Nutrisol	9
20.	VG	Leaf blade: presence of blotch	Limbe : présence d'une tache	Blattspreite: Vorhandensein eines Flecks	Lámina de la hoja: presencia de mancha		
(+)							
QL	(e)	absent	absente	fehlend	ausente	Eniko, Maros, Revancha	1
		present	présente	vorhanden	presente	Edit	9
21.	VG	Leaf blade: size of blotch in relation to blade	Limbe : taille de la tache par rapport au limbe	Blattspreite: Größe des Flecks im Verhältnis zur Spreite	Limbo: tamaño de la mancha con relación al limbo		
(+)							
QN	(e)	small	petite	klein	pequeño	Roja Tulyehualco	3
		medium	moyenne	mittel	mediano	Edit	5
		large	grande	groß	grande	Mixteco	7
22.	VG	Leaf blade: color of blotch	Limbe : couleur de la tache	Blattspreite: Farbe des Flecks	Limbo: color de la mancha		
(+)							
PQ	(e)	green	verte	grün	verde	I54	1
		silvery	argentée	silbrig	plateada	Mixteco SLPZ	2
		red	rouge	rot	roja	Edit	3
		purple	pourpre	purpurn	púrpura	L2ITAX	4
23.	VS	Leaf blade: shape distribution of blotch	Limbe : forme de la distribution de la tache	Blattspreite: Form der Verteilung des Flecks	Limbo: forma en que se distribuye la mancha		
(*)							
(+)							
QL	(e)	ovoid	ovoïde	eiförmig	ovalada	Edit	1
		“V” shaped	en “V”	V-förmig	en forma de “V”	Mixteco	2

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
24. (*)	VG	Inflorescence: color	Inflorescence : couleur	Blütenstand: Farbe	Inflorescencia: color	
PQ	(e)	yellow	jaune	gelb	amarillo	Amarilla 1
		green	verte	grün	verde	Eniko, Maros, Revancha 2
		pink	rose	rosa	rosado	Roza 3
		red	rouge	rot	rojo	Edit, Rojita 4
		purple	pourpre	purpurn	púrpura	Nutrisol, Reka 5
		brown	brune	braun	pardo	Tulyehualco 6
25. (+)	VG	Inflorescence: density	Inflorescence : densité	Blütenstand: Dichte	Inflorescencia: densidad	
QN	(e)	sparse	lâche	locker	laxa	Tulyehualco 3
		medium	moyenne	mittel	media	Nutrisol, Reka, Rojita 5
		dense	dense	dicht	densa	Edit, Eniko, Maros, Reka, Rojita, Roza 7
26. (+)	VG	Inflorescence: compactness	Inflorescence : compacité	Blütenstand: Kompaktheit	Inflorescencia: compacidad	
QN	(e)	compact	compacte	kompakt	compacta	Nutrisol, Rojita 3
		intermediate	intermédiaire	intermediär	intermedia	Revancha 5
		open	ouverte	locker	abierta	Roza 7
27. (*) (+)	VG	Inflorescence: type	Inflorescence : type	Blütenstand. Typ	Inflorescencia: tipo	
QL	(e)	amaranth form	en forme d'amarante	Fuchsschwanzform	amarantiforme	Nutrisol 1
		glomerulate	en forme de glomérule	Knäuelform	glomerulada	Reka, Revancha, Roza 2

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
28.	MS	Inflorescence: number of female flowers per glomerule	Inflorescence : nombre de fleurs femelles par glomérule	Blütenstand: Anzahl weibliche Blüten je Knäuel	Inflorescencia: número de flores femeninas por glomérulo	
QN	(e)	few	petit	gering	pocas	Nutrisol 3
		medium	moyen	mittel	medias	Maros, Roza, Revancha 5
		many	grand	groß	muchas	Reka 7
29. (*) (+)	VG	Inflorescence: size of bract relative to utricule	Inflorescence : taille de la bractée par rapport à l'utricule	Blütenstand: Größe des Deckblattes im Verhältnis zum Schlauch	Inflorescencia: tamaño de las brácteas con relación al utrículo	
QN	(e)	smaller	plus petite	kleiner	más pequeñas	Reka 1
		equal	égale	gleich groß	igual	Revancha 2
		larger	plus grande	größer	más grandes	Edit, Nutrisol 3
30. (*)	VG	Inflorescence: growth type	Inflorescence : type de croissance	Blütenstand: Wuchstyp	Inflorescencia: tipo de crecimiento	
QL	(e)	determinate	déterminée	determiniert	determinado	Eniko, Maros, Revancha 1
		indeterminate	indéterminée	nicht determiniert	indeterminado	Nutrisol 2
31. (+)	VG	Inflorescence: attitude	Inflorescence : port	Blütenstand: Haltung	Inflorescencia: porte	
QN	(e)	upright or very weakly recurved	dressé ou très faiblement retombant	aufrecht oder sehr leicht gebogen	erecto o muy débilmente recurvado	Nutrisol 1
		intermediate	intermédiaire	mittel	intermedio	Roza 2
		strongly recurved	fortement retombant	stark gebogen	fuertemente recurvado	Reka 3
32.	VG	Inflorescence: length	Inflorescence : longueur	Blütenstand: Länge	Inflorescencia: longitud	
QN	(e)	short	courte	kurz	corta	Edit 3
		medium	moyenne	mittel	media	Maros, Revancha, Roza 5
		long	longue	lang	larga	Nutrisol 7

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota	
33.	MG	Plant: time of maturity	Plante : époque de maturité	Pflanze: Zeitpunkt der Reife	Planta: época de madurez		
(+)							
QN	(f)	early	précoce	früh	precoz	Edit	3
		medium	moyenne	mittel	media	Maros, Revancha, Roza	5
		late	tardive	spät	tardía	Nutrisol	7
34.	MG	Plant: height (at maturity)	Plante : hauteur (à maturité)	Pflanze: Höhe (zum Zeitpunkt der Reife)	Planta: altura (en la madurez)		
(+)							
QN	(f)	short	basse	niedrig	baja	Edit	3
		medium	moyenne	mittel	media	Reka, Revancha, Roza	5
		tall	haute	hoch	alta	Nutrisol	7
35.	VG	Stem: anthocyanin coloration of base (at maturity)	Tige : pigmentation anthocyanique de la base (à maturité)	Stengel: Anthocyanfärbung der Basis (zum Zeitpunkt der Reife)	Tallo: pigmentación antocíánica de la base (en la madurez)		
(*)							
QL	(f)	absent	absente	fehlend	ausente	Revancha	1
		present	présente	vorhanden	presente	Nutrisol, Roza	9
36.	VG	Stem: shape in cross section (at maturity)	Tige : forme en section transversale (à maturité)	Stengel: Form im Querschnitt (zum Zeitpunkt der Reife)	Tallo: forma de la sección transversal (en la madurez)		
(*)							
(+)							
QL	(f)	circular	circulaire	rund	circular	Reka	1
		undulated	ondulée	gewellt	ondulado	Edit, Revancha, Roza	2
37.	VG	Seed: color	Graine : couleur	Samen: Farbe	Semilla: color		
(*)							
PQ	(g)	white	blanche	weiß	blanco	Edit, Maros, Revancha, Roza	1
		yellow	jaune	gelb	amarillo	ITAX0053	2
		brown	brune	braun	marrón	Mixteco café	3
		pink	rose	rosa	rosa	Reka	4
		black	noire	schwarz	negro	Mixteco negro	5

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
38. (* (+)	VG	Seed: shape	Graine : forme	Samen: Form	Semilla: forma	
PQ	(g)	spheroid	sphérique	kugelförmig	esferoide	1
		ellipsoid	ellipsoïde	elliptisch	elipsoidal	Nutrisol, Revancha 2
		discoid (flattened)	discoïde (aplatie)	scheibenförmig (abgeflacht)	discoide (aplanada)	Rojita 3
39. (*	VG	Seed: type	Graine : type	Samen: Typ	Semilla: tipo	
QL	(g)	crystalline	cristalline	kristallin	cristalino	Nutrisol, Rojita 1
		floury	farineuse	mehlig	harinoso	Edit, Revancha 2
40. (+)	MG	Seed: weight per 1000 grains at 10% moisture	Graine : poids pour 1000 graines à 10% d'humidité	Samen: Tausendkorn-gewicht bei 10 % Feuchtigkeit	Semilla: peso de 1000 semillas al 10% de humedad	
QN	(g)	low	faible	gering	bajo	3
		medium	moyen	mittel	medio	5
		high	élevé	hoch	alto	7
41. (+)	MG	Seed: pop percent (relative increase of volume)	Graine : pourcentage de l'expansion à sec (augmentation relative du volume)	Samen: Prozentsatz des Puffens (relative Zunahme des Volumens)	Semilla: porcentaje de rosetas (aumento relativo de volumen)	
QN	(g)	low	faible	niedrig	bajo	[to be provided or characteristic to be deleted] 3
		medium	moyen	mittel	medio	[to be provided or characteristic to be deleted] 5
		high	élevé	hoch	alto	[to be provided or characteristic to be deleted] 7

8. Explanations on the Table of Characteristics

8.1 *Explanations covering several characteristics*

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

- (a) Observations on the seedling which should be made 3-6 days after emergence
- (b) Observations on the seedling, which should be made on leaves 6-8
- (c) Observations should be made at vegetative stage just before inflorescence emergence
- (d) Observations should be made at beginning of inflorescence emergence
- (e) Observations should be made at full flowering: 50% of the plants
- (f) Observations should be made at physiological maturity
- (g) Observations should be made on dry seeds at harvest time

8.2 *Explanations for individual characteristics*

Ad. 7: Young leaf: position of widest point



1
towards base



2
in middle

Ad. 10: Young leaf: distribution of pigmentation of color at beginning of growth on upper side



1
colored basal area



2
central blotch



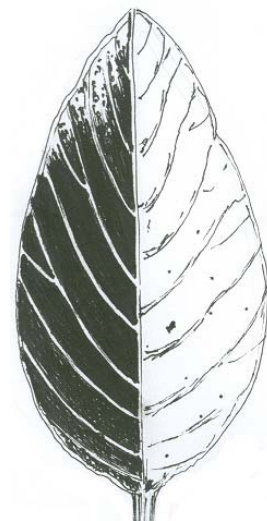
3
one "V" shaped stripe



4
2 "V" shaped stripes



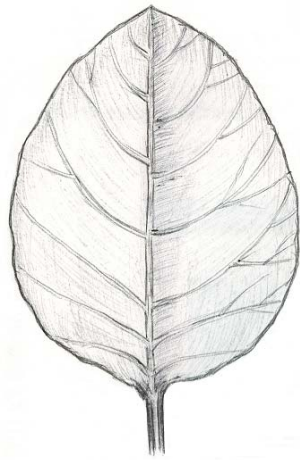
5
colored margin and veins



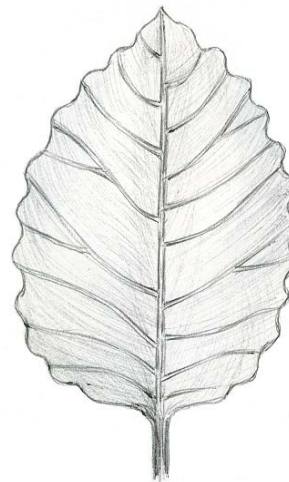
6
in a strip

Ad. 12: Leaf: type of margin

To be assessed on the last fully- developed leaf, before the inflorescence appears.



1
entire



2
sinuate

Ad. 14: Inflorescence: time of flowering

To be observed at full flowering (50% of the plant).

Ad. 20: Leaf blade: presence of blotch



1
absent



9
present

Ad. 21: Leaf blade: size of blotch in relation to blade



1
small



3
medium



5
large

Ad. 23: Leaf blade: shape distribution of blotch



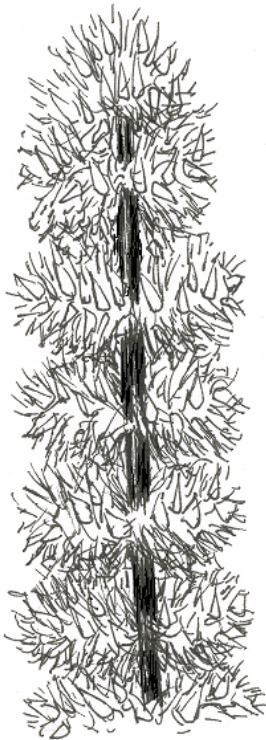
1
ovoid



2
"V" shaped

Ad. 25: Inflorescence: density

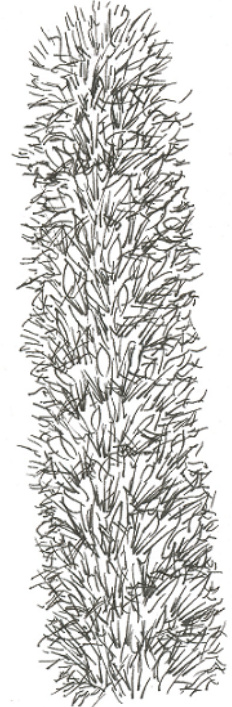
The density of the inflorescence relates to the number and position of the glomerules. The observation should be made on the main inflorescence.



3
sparse



5
medium



7
dense

Ad. 26: Inflorescence: compactness

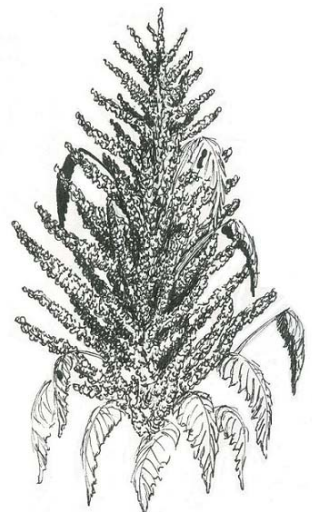
It is opening of the secondary axes through the main axis of the inflorescence.



3
compact



5
intermediate

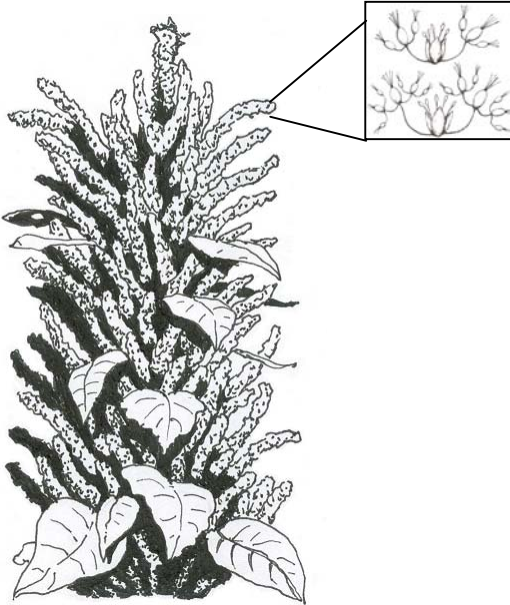


7
open

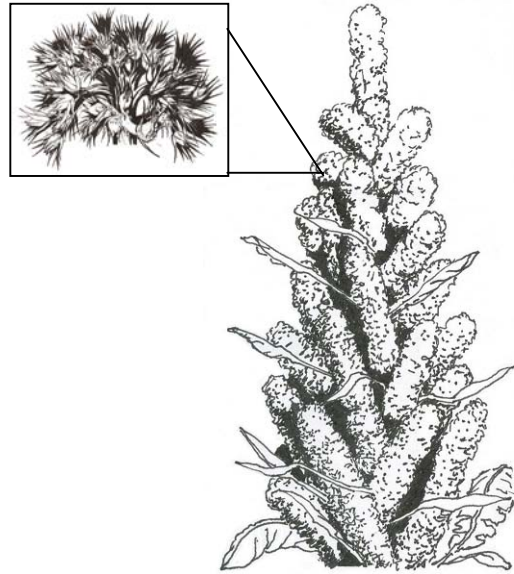
Ad. 27: Inflorescence: type

The qualification of this characteristic must be considered from the phase of flowering to grain filling, when observing if the glomerules of the panicle are inserted directly into the secondary axis and presenting/displaying an extended form denominating the “amaranth form” inflorescence.

On the other hand, if the glomerules are inserted in the axes glomerules and present/display a globe form, the inflorescence is denominating “glomerulate”.



1
amaranth form

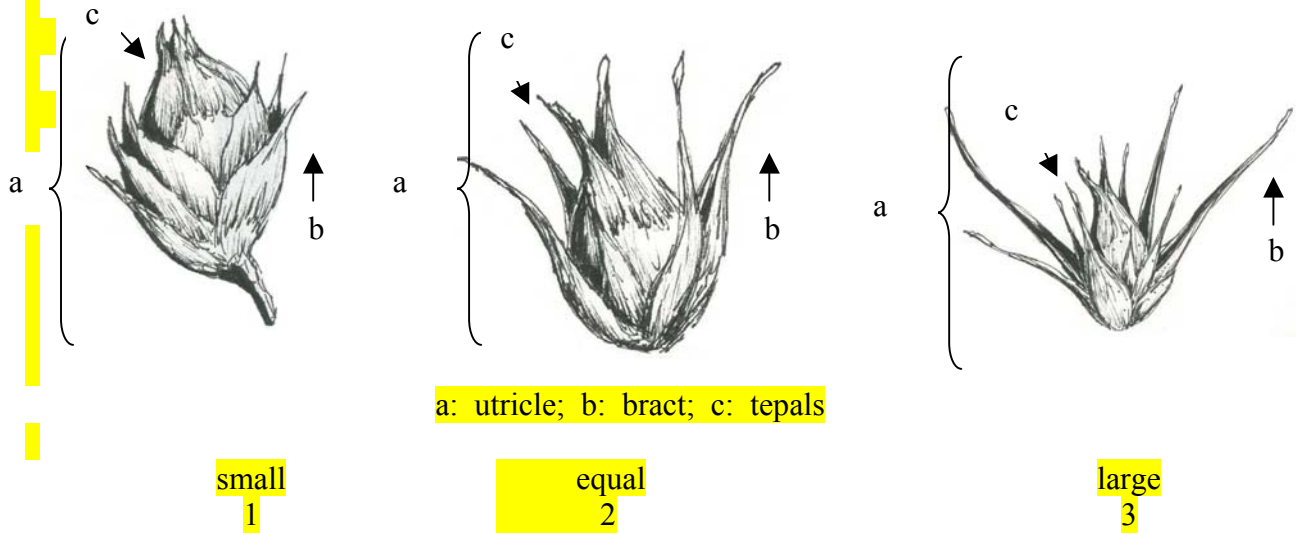


2
glomerulate

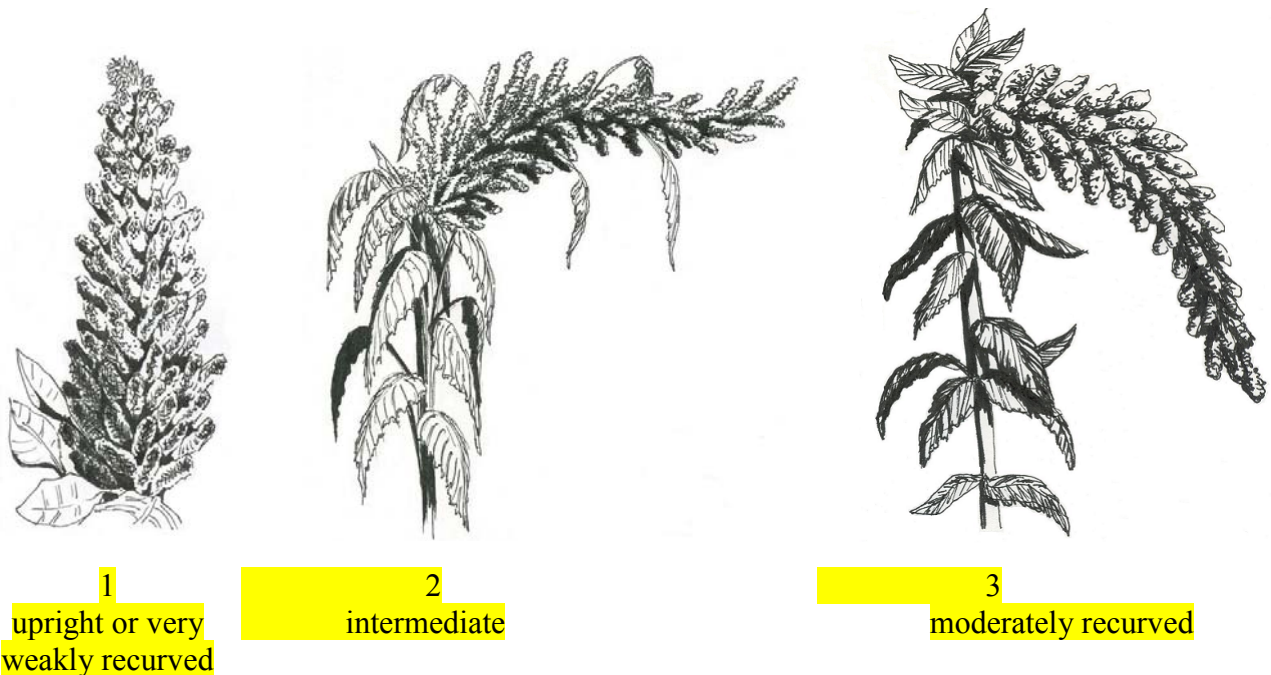
Ad. 29: Inflorescence: size of bract relative to utricle

In order to facilitate the qualification of this characteristic, it is recommended to observe it through a microscope and to identify the following structures:

The utricle is the complete structure that contains the seed. It is formed by the ballot box which is the developed ovary and contains the seed; the opercule is the dehiscent layer that covers the seed; the bracts are the structures that come after the tepals and protect the utricle and can be of different sizes in relation to this one.



Ad. 31: Inflorescence: attitude



Ad. 33: Plant: time of maturity

Physiological maturity is reached when smashing of seeds is no longer possible by pressing them using the fingers. Twenty seeds should be taken from the mid-part of the main inflorescence, after complete anthesis is 95%.

The change of inflorescence coloration is the most widely used criterion to determine physiological maturity. In green inflorescences coloration turns golden, whereas in red inflorescences coloration turns to brown-reddish. In this phase, if inflorescences are shaken, mature seeds fall down.

Ad. 34: Plant: height (at maturity)

To be measured from the base of the plant to the tip of the inflorescence.

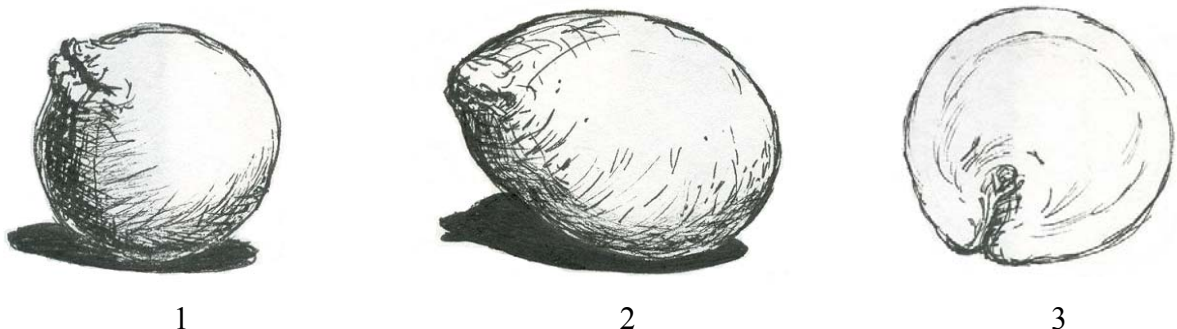
Ad. 36: Stem: shape in cross section (at maturity)



1
circular

2
undulated

Ad. 38: Seed: shape



1

2

3

spheroid

ellipsoid

discoid (flattened)

Ad. 40: Seed weight per 1,000 grains at 10% moisture

The seed weight should be measured on eight samples of 100 seeds, at a moisture of 10%.

In order to score this trait, the moisture content is first determined through the one-step method of oven drying.

A 2-gram seed sample is taken with two replications. The formula is as follows:

$$MC = \frac{P2 - P3}{P2 - P1} \times 100 \text{ (wet weight basis)} \longrightarrow \text{IMC}$$

Where:

MC = Moisture content

P1 = Weight in grams of the container and lid

P2 = Weight in grams of the container, lid and seeds

P3 = Weight in grams of the container, lid and seeds after dried in the oven

1,000 seeds from each replication are counted and weighed using a precision scale (W1000 S).

Based on the results obtained, an adjustment is made to obtain PMS at 10% of moisture (FMC).

This adjustment is obtained using the formula:

$$FW_{10\% \text{ of moisture}} = W \ 1000S \frac{(100 - \text{IMC})}{(100 - \text{FMC})}$$

Where:

FW = Final weight at the desired (10%) moisture level

W1000S = Weight of one-thousand seeds

IMC = Initial moisture

FMC = Final or desired (10%) moisture content

Ad. 41: Seed: pop percent (relative increase of volume)

The moisture content must be between 14 and 16%; if necessary, the seeds should be soaked.

To accomplish popping of the seed, the use of a Hot Air Flow Popper, working at a temperature of 220°C, is recommended. For the scoring of this trait, the seed moisture content should be determined before popping, since the Popping Expansion Volume (PEV) is directly related to the Moisture Content (MC) and genotype.

On the other hand, if optimization of the seed moisture content is desired (16%), water should be added to the seed because, since at harvest, seed typically has a moisture content of between 10 and 12%. While performing this test the absorption time of moisture by the seed should be taken into account because it is associated with the chemical composition of starch, to the size and shape of amylose/amylopectin.

$$IW (100 - IMC) = FW (100 - FMC) \longrightarrow FW (100 - IMC) = X (100 - FMC)$$

$$X = IW \frac{(100 - IMC)}{(100 - FMC)}$$

$$\text{Weight}_{(\text{add water})} = X - IW$$

Where:

IW: Initial weight

FW: Final weight at the desired moisture content

IMC: Initial moisture content

FMC: Final or desired moisture content

9. Literature

Baltensperger, D., 1991. Release of Plainsman (P. I. 538322). Grain Amaranth Legacy 4 (4): 7.

Bressani, R., 1990. Grain amaranth: chemical composition and nutritive value. Proc. National Amaranth. 4th symposium on perspectives on production. University of Minnesota, US, page 19.

Espitia, R.E., 1986. Caracterización y evaluación preliminar de germoplasma de *Amaranthus* spp. Tesis Profesional. UAAAN. Saltillo, Coahuila, MX.

Espitia, R.E., 1991a. Revancha: variedad mejorada de amaranto para los valles altos de México. *En*: Primer Congreso Internacional del Amaranto, Oaxtepec, Morelos, MX, page 64.

Espitia, R.E., 1991b. Estabilidad del rendimiento en amaranto. *En*: Primer Congreso Internacional del Amaranto, Oaxtepec, Morelos, MX, page 65.

Espitia, R.E., 1992. Razas mexicanas de amaranto. XIV Congresos Nacional de Citogenética. Tuxtla Gutiérrez, Chis. MX, page 669.

Espitia, R.E., 1994. Breeding of grain amaranth. *En*: O. Paredes López (ed.). *Amaranth biology, chemistry and technology*. CRC Press, Boca Raton, FL, US, pp. 23-28.

Hauptli, H., 1977. Agronomic potential and breeding amaranth. Proc. First Amaranth Seminar. Emmaus, Pa.

Hauptli, H., Jain, K., 1980. Genetic polymorphisms and yield components in a population of amaranth. *The Journal of Heredity* 71: pp290-292.

Kauffman, C.S., 1986. Observaciones sobre las investigaciones preliminares para el desarrollo de variedades mejoradas de amaranto de grano en cinco países. *En*: Primer Seminario Nacional del Amaranto. Chapingo, MX, pp. 280-285.

Kauffman, C.S., Weber, L.E., 1990. Grain amaranth. *En*: J. Janick and J. E. Simon (eds.). *Advances in New Crops*. Timber Press. Portland, OR, US, pp 127-139.

Kulakow, P.A., Hauptli H., Jain, S. K., 1985. Genetics of grain amaranths. I. Mendelian analysis of six color characteristics. *J. Hered.* 76: 27-30.

Kulakow, P.A., Jain S.K., 1985. The inheritance of flowering in *Amaranthus* species. *J. Genet.* 64: 85 – 100.

Kulakow, P.A., 1987. Genetics of grain amaranths II. The inheritance of determinance, panicle orientation, dwarfism, and embryo color in *A. caudatus*. *J. Hered.* 78: 293-297.

Kulakow, P.A., Jain S.K., 1987. Genetics of grain amaranths. IV Variation in early generation response to selection *in*: *Amaranthus cruentus* L. *Theor. Appl. Gen.* 74: 113-120.

National Research Council, 1984. Amaranth: modern prospects for ancient crop. National Academy Press, Washington, D. C., US, pp. 80.

Sauer, J.D., 1950. The grain amaranthus. A survey of their history and classification. Annals of the Missouri Botanical garden, US, 37: 561-632.

Sauer, J.D., 1976. The grain amaranths and their relatives: a revised taxonomic and geographic survey. Annals of Missouri Botanical Garden. 54:103-137.

Waiker, W.G., Rockwell W.C., Kohler G.O., 1970. Preparation and evaluation of popped grains for use. Cereal Chem. 47.

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 Botanical Name	<input type="text" value="Amaranthus L."/>	
1.2 Common Name	<input type="text" value="Amaranth"/>	
2. Applicant		
Name	<input type="text"/>	
Address	<input type="text"/>	
Telephone No.	<input type="text"/>	
Fax No.	<input type="text"/>	
E-mail address	<input type="text"/>	
Breeder (if different from applicant)	<input type="text"/>	
3. Proposed denomination and breeder's reference		
Proposed denomination (if available)	<input type="text"/>	
Breeder's reference	<input type="text"/>	

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 varieties)

(b) partially known cross []
(please state known parent variety(ies))

(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)

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 []

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:
-------------------------	-----------------	-------------------

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 Cotyledon: anthocyanin coloration (1)		
absent	Eniko, Maros, Revancha	1 []
present	Edit, Nutrisol, Reka, Rojita	9 []
5.2 Seedling: anthocyanin coloration of hypocotyls (2)		
absent	Amarilla	1 []
present	Edit, Nutrisol, Rojita	9 []
5.3 Petiole: anthocyanin coloration (18)		
absent	Edit, Revancha, Rojita	1 []
present	Nutrisol, Reka, Roza	9 []

TECHNICAL QUESTIONNAIRE		Page {x} of {y}	Reference Number:
	Characteristics	Example Varieties	Note
5.4	Leaf blade: presence of blotch		
(20)			
	absent	Eniko, Maros, Revancha	1 []
	present	Edit	9 []
5.5	Leaf blade: shape distribution of blotch		
(23)			
	ovoid	Edit	1 []
	“V”shaped	Mixteco	2 []
5.6	Inflorescence: color		
(24)			
	yellow	Amarilla	1 []
	green	Eniko, Maros, Revancha	2 []
	pink	Roza	3 []
	red	Edit, Rojita	4 []
	purple	Nutrisol, Reka	5 []
	brown	Tulyehualco	6 []
5.7	Inflorescence: type		
(27)			
	amaranth form	Nutrisol	1 []
	glomerulate	Reka, Revancha, Roza	2 []
5.8	Inflorescence: size of bract relative to utricle		
(29)			
	smaller	Reka	1 []
	equal	Revancha	2 []
	larger	Edit, Nutrisol	3 []
5.9	Inflorescence: growth type		
(30)			
	determinate	Eniko, Maros, Revancha	1 []
	indeterminate	Nutrisol	2 []

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

Characteristics	Example Varieties	Note
5.10 Stem: anthocyanin coloration of base (at maturity) (35)		
absent	Revancha	1 []
present	Nutrisol, Roza	9 []
5.11 Stem: shape in cross section (at maturity) (36)		
circular	Reka	1 []
undulated	Edit, Revancha, Roza	2 []
5.12 Seed: color (37)		
white	Edit, Maros, Revancha, Roza	1 []
yellow	ITAX0053	2 []
brown	Mixteco café	3 []
pink	Reka	4 []
black	Mixteco negro	5 []
5.13 Seed: shape (38)		
spheroid		1 []
ellipsoid	Nutrisol, Revancha	2 []
discoid (flattened)	Rojita	3 []
5.14 Seed: type (39)		
crystalline	Nutrisol, Rojita	1 []
floury	Edit, 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
<i>Example</i>		<i>(example to be inserted)</i>	<i>(example to be inserted)</i>

Comments:

#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.

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

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]

