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| **INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS** | | |
| GENEVA | | |

DRAFT

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|  | **MAIZE**  UPOV Code: ZEAAA\_MAY  *Zea mays* L. | [[1]](#footnote-1)\* |

**GUIDELINES**

**FOR THE CONDUCT OF TESTS**

**FOR DISTINCTNESS, UNIFORMITY AND STABILITY**

*prepared by an expert from the Netherlands (Kingdom of the)*

*to be considered by the*

*Technical Committee at its sixty-first session,*

*to be held Geneva from 2025-10-20 to 2025-10-21*

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

This document contains the following changes proposed by the Technical Working Party for Vegetables (TWV), at its fifty-ninth session[[2]](#footnote-2), presented in grey highlight:

1. Revision of characteristics 24.1 and 24.2 “Plant: length” (There is a need to separate inbred lines from hybrids varieties for this characteristic. Plants of inbred lines are always clearly shorter than hybrids ones, therefore two different scales are needed);
2. Revision of characteristics 32: “Only varieties with ear type of grain: sweet or waxy: Ear: number of colors of grains” and 38: “Ear: main color of top of grain";
3. Addition of new characteristic after characteristic 38 and explanation “Ear: secondary color of grain” to the Table of Characteristics and TQ 5.

Alternative Names:\*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *Botanical name* | *English* | *French* | *German* | *Spanish* |
| *Zea mays* L. | Maize, Corn | Maïs | Mais | Maíz |

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.

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ANNEX 54

# Subject of these Test Guidelines

These Test Guidelines apply to all varieties of *Zea mays* L. (excluding ornamental varieties).

# 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:

1,500 grains for inbred lines;

1 kg for hybrids and open-pollinated varieties.

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.

# 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

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.

3.3.1 Stage of development for the assessment

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

##### Type of observation

The recommended method of observing the characteristic 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

## 3.4 Test Design

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

## 3.5 Number of Plants / Parts of Plants to be Examined

3.5.1 Inbred lines and single hybrids: All observations on single plants (MS) should be made on 10 plants or parts taken from each of 10 plants and all other observations made on all plants in the test.

3.5.2 Other types of hybrids: All observations on single plants (MS) should be made on 20 plants or parts taken from each of 20 plants and all other observations made on all plants in the test.

3.5.3 Open-pollinated varieties: All observations on single plants (MS) should be made on 40 plants or parts taken from each of 40 plants and all other observations made on all plants in the test.

## 3.6 Additional Tests

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

# 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.

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

1. description of parental lines according to the Test Guidelines;
2. check of the originality of the parental lines in comparison with the reference collection, based on the characteristics in Section 7 in order to screen the closest inbred lines;
3. check of the originality of the hybrid formula in comparison with those of the hybrids in common knowledge, taking into account the closest inbred lines;
4. assessment of the distinctness at the hybrid level of varieties with a similar formula.

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 and single hybrids, a population standard of 3% and an acceptance probability of at least 95% should be applied. In the case of a sample size of 40 plants, 3 off-types are allowed. In addition, the same population standard and acceptance probability should apply to clear cases of out-crossed plants in inbred lines as well as plants obviously resulting from the selfing of a parent line in single-cross hybrids (clear difference in plant height, size of ear or earliness as well as proof through isozyme polymorphism).

4.2.3 For three-way cross hybrids, double cross hybrids and open-pollinated varieties, the variability within the variety should not exceed the variability of comparable varieties already known.

4.2.4 The assessment of uniformity for open-pollinated varieties should be according to the recommendations for cross-pollinated varieties 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.

4.3.2 Where appropriate, or in cases of doubt, stability of inbred lines or open-pollinated varieties may be tested, either by growing a further generation, or by testing a new seed stock to ensure that it exhibits the same characteristics as those shown by the previous material supplied.

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

# 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) Tassel: time of anthesis (characteristic 8)

(b) Tassel: anthocyanin coloration at base of glume (characteristic 9)

(c) Ear: anthocyanin coloration of silks (characteristic 16)

(d) Plant: length (characteristic 24)

(e) Ear: type of grain (characteristic 36)

(f) Excluding varieties with ear type of grain: sweet: Ear: color of dorsal side of grain (characteristic 40)

(g) Ear: anthocyanin coloration of glumes of cob (characteristic 42)

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

# 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

(S): Possible segregation in three-way and double-cross hybrid varieties

MG, MS, VG: See Chapter 3.3.2

PC: Popcorn variety

SC: Sweet corn variety

(a)-(e) See explanations on the Table of Characteristics in Chapter 8.1

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

14-93 See explanations on the Table of Characteristics in Chapter 8.2 (Decimal Code for the Growth Stages)

# Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres

|  |  | English | français | deutsch | español | Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo | Note/ Nota |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | 14 (S) VG | First leaf: anthocyanin coloration of sheath | Première feuille: pigmentation anthocyanique de la gaine | Primärblatt: Anthocyanfärbung der Blattscheide | Primera hoja: pigmentación antociánica de la vaina |  |  |
| **QN** |  | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | 0674, Jubilee (SC) | 1 |
|  |  | weak | faible | gering | débil | MO17, Puma (SC) | 3 |
|  |  | medium | moyenne | mittel | media | F252, Gyöngymazsola (SC) | 5 |
|  |  | strong | forte | stark | fuerte | F244 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 2.  (+) | 14 VG | First leaf: shape of apex | Première feuille: forme du sommet | Primärblatt: Form der Spitze | Primera hoja: forma del ápice |  |  |
| **PQ** |  | pointed | pointu | spitz | puntiaguda |  | 1 |
|  |  | pointed to rounded | pointu à arrondi | spitz bis abgerundet | puntiaguda a redondeada | 0674 | 2 |
|  |  | rounded | arrondi | abgerundet | redondeada | Empire (SC), F816 | 3 |
|  |  | rounded to spatulate | arrondi à spatulé | abgerundet bis spatelförmig | redondeada a espatulada | F259, Merkur (SC) | 4 |
|  |  | spatulate | spatulé | spatelförmig | espatulada | EP1 | 5 |
| 3. | 51-59 VG | Foliage: intensity of green color | Feuillage: intensité de la couleur verte | Laub: Intensität der Grünfärbung | Follaje: intensidad del color verde |  |  |
| **QN** |  | light | claire | hell | claro | W182E | 1 |
|  |  | medium | moyenne | mittel | medio | Empire (SC), W117 | 2 |
|  |  | dark | foncée | dunkel | oscuro | GSS 3287 (SC), W401 | 3 |
| **4.  (+)** | **51-59 VG** | **Leaf: undulation of margin of blade** | **Feuille: ondulation du bord du limbe** | **Blatt: Wellung des Randes der Spreite** | **Hoja: ondulación del borde del limbo** |  |  |
| **QN** | **(a)** | absent or very weak | absente ou très faible | fehlend oder sehr gering | ausente o muy débil | F2 | 1 |
|  |  | intermediate | moyenne | mittel | media | F252, Puma (SC) | 2 |
|  |  | strong | forte | stark | fuerte | Empire (SC), F259 | 3 |
| 5.   (+) | 65-69 VG | Leaf: angle between blade and stem | Feuille: angle entre le limbe et la tige | Blatt: Winkel zwischen Spreite und Stengel | Hoja: ángulo entre el limbo y el tallo |  |  |
| **QN** | **(a)** | very small | très petit | sehr klein | muy pequeño |  | 1 |
|  |  | small | petit | klein | pequeño | A188 | 3 |
|  |  | medium | moyen | mittel | medio | F66, GH 2547 (SC) | 5 |
|  |  | large | grand | groß | grande | F186, Spirit (SC) | 7 |
|  |  | very large | très grand | sehr groß | muy grande |  | 9 |
| 6.  (+) | 65-69 VG | Leaf: curvature of blade | Feuille: courbure du limbe | Blatt: Biegung der Spreite | Hoja: curvatura del limbo |  |  |
| **QN** | **(a)** | absent or very slightly recurved | absente ou très légèrement incurvé | fehlend oder sehr leicht gebogen | ausente o muy ligeramente recurvada | WD36 | 1 |
|  |  | slightly recurved | légèrement incurvé | leicht gebogen | ligeramente recurvada | A654, Bonus (SC) | 3 |
|  |  | moderately recurved | modérément incurvé | mäßig gebogen | moderadamente recurvada | Jubilee (SC), W117 | 5 |
|  |  | strongly recurved | fortement incurvé | stark gebogen | fuertemente recurvada | W79A | 7 |
|  |  | very strongly recurved | très fortement incurvé | sehr stark gebogen | muy fuertemente recurvada |  | 9 |
| 7. | 65-69 VG | Stem: degree of zig-zag | Tige: degré du zig-zag | Stengel: Zickzack-ausprägung | Tallo: grado de zigzagueo |  |  |
| **QN** |  | absent or very slight | nul ou très faible | fehlend oder sehr gering | ausente o muy ligero | F2 | 1 |
|  |  | slight | faible | mäßig | débil | F186 | 2 |
|  |  | strong | fort | deutlich | fuerte | F66 | 3 |
| 8. (\*) (+) | MG | Tassel: time of anthesis | Panicule: époque de floraison mâle | Rispe: Zeitpunkt der männlichen Blüte | Panícula: época de la antesis |  |  |
| **QN** | **(b)** | very early | très précoce | sehr früh | muy temprana |  | 1 |
|  |  | very early to early | très précoce à précoce | sehr früh bis früh | temprana a muy temprana | KW1069, Spirit (SC) | 2 |
|  |  | early | précoce | früh | temprana | Champ (SC), F257 | 3 |
|  |  | early to medium | précoce à moyenne | früh bis mittel | temprana a media | Centurion (SC), F259 | 4 |
|  |  | medium | moyenne | mittel | media | F522, Zenith (SC) | 5 |
|  |  | medium to late | moyenne à tardive | mittel bis spät | media a tardía | A632 | 6 |
|  |  | late | tardive | spät | tardía | B73 | 7 |
|  |  | late to very late | tardive à très tardive | spät bis sehr spät | tardía a muy tardía | AM1513 | 8 |
|  |  | very late | très tardive | sehr spät | muy tardía |  | 9 |
| 9. (\*) (+) | 65-69 (S) VG | Tassel: anthocyanin coloration at base of glume | Panicule: bourrelet (anneau anthocyanique)  en-dessous de la glume | Rispe: Anthocyanfärbung an der Basis der Hüllspelze | Panícula: pigmentación antociánica en la base de la gluma |  |  |
| **QN** | **(b)** | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | Royalty (SC), W117 | 1 |
|  |  | weak | faible | gering | débil | Boston (SC), F66 | 3 |
|  |  | medium | moyenne | mittel | media | F107 | 5 |
|  |  | strong | forte | stark | fuerte | EP1 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 10.  (+) | 65-69 (S) VG | Tassel: anthocyanin coloration of glumes excluding base | Panicule: pigmentation anthocyanique des glumes à l'exclusion de la base | Rispe: Anthocyan­färbung der Hüllspelze ohne Basis | Panícula: pigmentación antociánica de las glumas, con exclusión de la base |  |  |
| **QN** | **(b)** | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | Empire (SC), F259 | 1 |
|  |  | weak | faible | gering | débil | F2, Royalty (SC) | 3 |
|  |  | medium | moyenne | mittel | media | Centurion (SC), WD36 | 5 |
|  |  | strong | forte | stark | fuerte | W79A | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 11. (+) | VG (S) | Tassel: anthocyanin coloration of anthers | Panicule: pigmentation anthocyanique des anthères | Rispe: Anthocyanfärbung der Antheren | Panícula: pigmentación antociánica de las anteras |  |  |
| **QN** | **(b)** | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | A654, Empire (SC) | 1 |
|  |  | weak | faible | gering | débil | F2, Royalty (SC) | 3 |
|  |  | medium | moyenne | mittel | media | Centurion (SC), W182E | 5 |
|  |  | strong | forte | stark | fuerte |  | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 12.  (\*) (+) | 65-69 VG | Tassel: angle between main axis and lateral branches | Panicule: angle entre l'axe central et les ramifications latérales | Rispe: Winkel zwischen der Mittelachse und den Seitenästen | Panícula: ángulo entre el eje central y las ramas laterales |  |  |
| **QN** | **(c)** | very small | très petit | sehr klein | muy pequeño |  | 1 |
|  |  | small | petit | klein | pequeño | F492 | 3 |
|  |  | medium | moyen | mittel | medio | EP1,  Mv. Aranyos (SC) | 5 |
|  |  | large | grand | groß | grande | Bonus (SC), F186 | 7 |
|  |  | very large | très grand | sehr groß | muy grande |  | 9 |
| 13.  (\*) (+) | 69 (S) VG | Tassel: curvature of lateral branches | Panicule: courbure des ramifications | Rispe: Biegung der Seitenäste | Panícula: curvatura de las ramas laterales |  |  |
| **QN** | **(c)** | absent or very slightly recurved | absente ou très légèrement incurvées | fehlend oder sehr leicht gebogen | ausente o muy ligeramente recurvada | El Toro (SC), F257 | 1 |
|  |  | slightly recurved | légèrement incurvées | leicht gebogen | ligeramente recurvada | Empire (SC), F816 | 3 |
|  |  | moderately recurved | modérément incurvées | mäßig gebogen | moderadamente recurvada | Bonus (SC), W182E | 5 |
|  |  | strongly recurved | fortement incurvées | stark gebogen | fuertemente recurvada | F66 | 7 |
|  |  | very strongly recurved | très fortement incurvées | sehr stark gebogen | muy fuertemente recurvada |  | 9 |
| 14. (\*) | 65-75 MS/ VG | Tassel: number of primary lateral branches | Panicule: nombre de ramifications primaires | Rispe: Anzahl der Seitenäste erster Ordnung | Panícula: número de ramificaciones primarias |  |  |
| **QN** |  | absent or very few | nul ou très petit | fehlend oder sehr gering | nulo o muy bajo | F7 | 1 |
|  |  | few | petit | gering | bajo | F252,  Mv. Aranyos (SC) | 3 |
|  |  | medium | moyen | mittel | medio | F244, Kokanee (SC) | 5 |
|  |  | many | grand | groß | grande | A188, Zenith (SC) | 7 |
|  |  | very many | très grand | sehr groß | muy grande | Suregold (SC) | 9 |
| 15.    (+) | MG | Ear: time of silk emergence | Épi: époque d'apparition des soies | Kolben: Zeitpunkt des Erscheinens der Narbenfäden | Mazorca: época de la aparición de los estigmas |  |  |
| **QN** |  | very early | très précoce | sehr früh | muy temprana | Mv. Aranyos (SC) | 1 |
|  |  | very early to early | très précoce à précoce | sehr früh bis früh | temprana a muy temprana | KW1069, Spirit (SC) | 2 |
|  |  | early | précoce | früh | temprana | Champ (SC), F257 | 3 |
|  |  | early to medium | précoce à moyenne | früh bis mittel | temprana a media | F259, Royalty (SC) | 4 |
|  |  | medium | moyenne | mittel | media | Bonus (SC), F522 | 5 |
|  |  | medium to late | moyenne à tardive | mittel bis spät | media a tardía | A632 | 6 |
|  |  | late | tardive | spät | tardía | B73 | 7 |
|  |  | late to very late | tardive à très tardive | spät bis sehr spät | tardía a muy tardía | AM1513 | 8 |
|  |  | very late | très tardive | sehr spät | muy tardía |  | 9 |
| 16.  (\*) | 65 (S) VG | Ear: anthocyanin coloration of silks | Épi: pigmentation anthocyanique des soies | Kolben: Anthocyanfärbung der Narbenfäden | Mazorca: pigmentación antociánica de los estigmas |  |  |
| **QN** |  | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | Bonus (SC), F7, F195, | 1 |
|  |  | weak | faible | gering | débil | El Toro (SC), F257 | 3 |
|  |  | medium | moyenne | mittel | media | F244, Gyöngymazsola (SC) | 5 |
|  |  | strong | forte | stark | fuerte | W401 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 17.   (+) | 65-75 (S) VG | Stem: anthocyanin coloration of brace roots | Tige: pigmentation anthocyanique des racines d'ancrage | Stengel: Anthocyanfärbung der Stelzwurzeln | Tallo: pigmentación antiociánica de las raíces de anclaje |  |  |
| **QN** |  | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | F16, Jubilee (SC) | 1 |
|  |  | weak | faible | gering | débil | Puma (SC), W117 | 3 |
|  |  | medium | moyenne | mittel | media | El Toro (SC), WD36 | 5 |
|  |  | strong | forte | stark | fuerte | EP1 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 18. | 61-71 VG | Tassel: density of spikelets | Panicule: densité des épillets | Rispe: Dichte der Ährchen | Panícula: densidad de las espiguillas |  |  |
| **QN** | **(b)** | moderately lax | modérément lâche | mäßig locker | moderadamente baja | F16 | 3 |
|  |  | medium | moyenne | mittel | media | EP1, Royalty (SC) | 5 |
|  |  | moderately dense | modérément compacte | mäßig dicht | moderadamente alta | Empire (SC), F259 | 7 |
| 19.   (+) | 71-75 (S) VG | Leaf: anthocyanin coloration of sheath | Feuille: pigmentation anthocyanique de la gaine | Blatt: Anthocyanfärbung der Blattscheide | Hoja: pigmentación antociánica de la vaina |  |  |
| **QN** |  | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | Jubilee (SC), W401 | 1 |
|  |  | weak | faible | gering | débil | F107 | 3 |
|  |  | medium | moyenne | mittel | media | F257 | 5 |
|  |  | strong | forte | stark | fuerte | EP1 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 20.   (+) | 71-75 (S) VG | Stem: anthocyanin coloration of internodes | Tige: pigmentation anthocyanique des entre-nœuds | Stengel : Anthocyanfärbung der Internodien | Tallo: pigmentación antociánica de los entrenudos |  |  |
| **QN** |  | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | F259, Jubilee (SC) | 1 |
|  |  | weak | faible | gering | débil | F816 | 3 |
|  |  | medium | moyenne | mittel | media | W79A | 5 |
|  |  | strong | forte | stark | fuerte | F257 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |
| 21.   (+) | 71-75 MS | Tassel: length of main axis above lowest lateral branch | Panicule: longueur de l'axe central au-dessus du rameau inférieur | Rispe: Länge der Mittelachse oberhalb des untersten Seitenastes | Panícula: longitud del eje central encima de la rama lateral más baja |  |  |
| **QN** |  | very short | très court | sehr kurz | muy corto |  | 1 |
|  |  | short | court | kurz | corto | EP1 | 3 |
|  |  | medium | moyen | mittel | medio | Bonus (SC), F244 | 5 |
|  |  | long | long | lang | largo | Empire (SC), F492 | 7 |
|  |  | very long | très long | sehr lang | muy largo |  | 9 |
| 22.  (\*) (+) | 71-75 MS | Tassel: length of main axis above highest lateral branch | Panicule: longueur de l'axe central au-dessus du rameau supérieur | Rispe: Länge der Mittelachse oberhalb des obersten Seitenastes | Panícula: longitud del eje central encima de la rama lateral más alta |  |  |
| **QN** |  | very short | très court | sehr kurz | muy corto |  | 1 |
|  |  | short | court | kurz | corto | EP1 | 3 |
|  |  | medium | moyen | mittel | medio | W182E | 5 |
|  |  | long | long | lang | largo | F492 | 7 |
|  |  | very long | très long | sehr lang | muy largo |  | 9 |
| 23. | 71-75 MS | Tassel: length of lateral branch | Panicule: longueur du rameau | Rispe: Länge der Seitenäste | Panícula: longitud de la rama lateral lateral |  |  |
| **QN** | **(c)** | very short | très court | sehr kurz | muy corta |  | 1 |
|  |  | short | court | kurz | corta | EP1 | 3 |
|  |  | medium | moyen | mittel | media | A632 | 5 |
|  |  | long | long | lang | larga | F492 | 7 |
|  |  | very long | très long | sehr lang | muy larga |  | 9 |
| 24.1  (\*) (+) | MS 75-85 | Only inbred lines: Plant: length | Seulement pour les lignées: Plante: longueur | Nur Inzuchtlinien: Pflanze: Länge | Sólo variedades: Planta: longitud |  |  |
| **QN** |  | very short | très courte | sehr kurz | muy corta | F7 | 1 |
|  |  | very short to short | très courte à courte | sehr kurz bis kurz | muy corta a corta |  | 2 |
|  |  | short | courte | kurz | corta | W117 | 3 |
|  |  | short to medium | courte à moyenne | kurz bis mittel | corta a media |  | 4 |
|  |  | medium | moyenne | mittel | media | F244 | 5 |
|  |  | medium to long | moyenne à longue | mittel bis lang | media a larga |  | 6 |
|  |  | long | longue | lang | larga | WD36 | 7 |
|  |  | long to very long | longue à très longue | lang bis sehr lang | larga a muy larga |  | 8 |
|  |  | very long | très longue | sehr lang | muy larga |  | 9 |
| 24.2 (\*) (+) | MS 75-85 | Only hybrids and open-pollinated varieties: Plant: length | Seulement pour les hybrides et les variétés à fécondation libre: Plante: longueur | Nur Hybriden und freiabblühende Sorten: Pflanze: Länge | Sólo híbridos y variedades de polinización libre: Planta: longitud |  |  |
| **QN** |  | very short | très courte | sehr kurz | muy corta |  | 1 |
|  |  | very short to short | très courte à courte | sehr kurz bis kurz | muy corta a corta |  | 2 |
|  |  | short | courte | kurz | corta | PR39D23,  Spirit (SC) | 3 |
|  |  | short to medium | courte à moyenne | kurz bis mittel | corta a media |  | 4 |
|  |  | medium | moyenne | mittel | media | PR37Y12,  Puma (SC) | 5 |
|  |  | medium to long | moyenne à longue | mittel bis lang | media a larga |  | 6 |
|  |  | long | longue | lang | larga | DKC5166,  Royalty (SC) | 7 |
|  |  | long to very long | longue à très longue | lang bis sehr lang | larga a muy larga |  | 8 |
|  |  | very long | très longue | sehr lang | muy larga | Enterprise (SC) | 9 |
| 25.  (+) | 75-85 MG | Plant: ratio height of insertion of peduncle of upper ear to plant length | Plante: hauteur d'insertion du pédoncule de l'épi le plus haut par rapport à la longueur de la plante | Pflanze: Verhältnis der Ansatzhöhe des Kolbenstiels des obersten Kolbens zur Pflanzenlänge | Planta: relación entre la altura de inserción del pedúnculo de la mazorca más alta y la longitud de la planta |  |  |
| **QN** |  | very small | très petit | sehr klein | muy pequeña | Gyöngymazsola (SC) | 1 |
|  |  | small | petit | klein | pequeña | F816, Spirit (SC) | 3 |
|  |  | medium | moyen | mittel | media | F252, Royalty (SC) | 5 |
|  |  | large | grand | groß | grande | F481 | 7 |
|  |  | very large | très grand | sehr groß | muy grande |  | 9 |
| 26. | 75-85 MS | Leaf: width of blade | Feuille: largeur du limbe | Blatt: Breite der Spreite | Hoja: anchura del limbo |  |  |
| **QN** | **(a)** | very narrow | très étroit | sehr schmal | muy estrecho |  | 1 |
|  |  | narrow | étroit | schmal | estrecho | Champ (SC), F16 | 3 |
|  |  | medium | moyen | mittel | medio | Empire (SC), F244 | 5 |
|  |  | wide | large | breit | ancho | Centurion (SC), F481 | 7 |
|  |  | very wide | très large | sehr breit | muy ancho |  | 9 |
| 27. | 75-85 VG | Peduncle: length | Pédoncule: longueur | Kolbenstiel: Länge | Pedúnculo: longitud |  |  |
| **QN** |  | very short | très court | sehr kurz | muy corto |  | 1 |
|  |  | short | court | kurz | corto | Centurion (SC), F259 | 3 |
|  |  | medium | moyen | mittel | medio | A654, Jubilee (SC) | 5 |
|  |  | long | long | lang | largo | F107 | 7 |
|  |  | very long | très long | sehr lang | muy largo |  | 9 |
| 28. (\*) (+) | **92-93 sweet-corn 75-79 MS** | Ear: length | Épi: longueur | Kolben: Länge | Mazorca: longitud |  |  |
| **QN** |  | very short | très court | sehr kurz | muy corta |  | 1 |
|  |  | short | court | kurz | corta | F2 | 3 |
|  | medium | moyen | mittel | media | A654, Spirit (SC) | 5 |
|  |  | long | long | lang | larga | Empire (SC), MO17 | 7 |
|  |  | very long | très long | sehr lang | muy larga |  | 9 |
| 29. | 92-93 sweet-corn 75-79 MS | Ear: diameter  (in middle) | Épi: diamètre  (au milieu) | Kolben: Durch-messer (in der Mitte) | Mazorca: diámetro (en el medio) |  |  |
| **QN** |  | very small | très petit | sehr klein | muy pequeño |  | 1 |
|  |  | small | petit | klein | pequeño | F7 | 3 |
|  | medium | moyen | mittel | medio | W117 | 5 |
|  |  | large | grand | groß | grande | Centurion (SC), F481 | 7 |
|  |  | very large | très grand | sehr groß | muy grande | Empire (SC) | 9 |
| 30.  (+) | 92-93 sweet-corn 75-79 VG | Ear: shape | Epi: forme | Kolben: Form | Mazorca: forma |  |  |
| **QN** |  | conical | conique | konisch | cónica | F16, Wombat (SC) | 1 |
|  |  | conico-cylindrical | cylindro-conique | konisch-zylindrisch | cilindrocónica | Centurion (SC), F816 | 2 |
|  | cylindrical | cylindrique | zylindrisch | cilíndrica | F66, GH2547 (SC) | 3 |
| 31. | 92-93 sweet-corn 75-93 MS | Ear: number of rows of grain | Épi: nombre de rangs | Kolben: Anzahl der Kornreihen | Mazorca: número de hileras de granos |  |  |
| **QN** |  | very few | très petit | sehr gering | muy bajo |  | 1 |
|  |  | few | petit | gering | bajo | F257 | 3 |
|  | medium | moyen | mittel | medio | Dessert 73 (SC), F16 | 5 |
|  |  | many | grand | groß | alto | B73, Bonus (SC) | 7 |
|  |  | very many | très grand | sehr groß | muy alto |  | 9 |
| 32. | 75-79 (S) VG | Only varieties with ear type of grain: sweet, pop or waxy: Ear: number of colors of grains | Seulement pour les variétés avec type de grain de l’épi: doux, à éclater ou cireux: Épi: nombre de couleurs de grains | Nur Sorten mit Kolben: Korntyp: Zuckermais, Popcorn oder Wachsmais: Kolben: Anzahl Farben der Körner | Sólo variedades con mazorca con tipo de grano: dulce, palomero o ceroso: Mazorca: número de colores de los granos |  |  |
| **QL** | **(e)** | one | une | eine | uno | Jubilee (SC) | 1 |
|  |  | two | deux | zwei | dos | Eolrukchal-ilho, Serendipity (SC) | 2 |
| 33.  (\*) | 75-79 VG | Only varieties with ear type of grain: sweet: Grain: intensity of yellow color | Seulement pour les variétés avec le type de grain: doux: Grain: intensité de la couleur jaune | Nur Sorten mit Kolben: Korntyp: Zuckermais: Korn: Intensität der Gelbfärbung | Sólo variedades con mazorca con tipo de grano: dulce: Grano: intensidad del color amarillo |  |  |
| **QN** | **(e)** | light | claire | hell | claro | Gyöngymazsola (SC) | 3 |
|  |  | medium | moyenne | mittel | medio | Royalty (SC) | 5 |
|  |  | dark | foncée | dunkel | oscuro | Kokanee (SC) | 7 |
| 34. | 75-79 VG | Only varieties with ear type of grain: sweet: Grain: length | Seulement pour les variétés avec le type de grain de l’épi: doux: Grain: longueur | Nur Sorten mit Kolben: Korntyp: Zuckermais: Korn: Länge | Sólo variedades con mazorca con tipo de grano: dulce: Grano: longitud |  |  |
| **QN** | **(d)** | short | court | kurz | corto |  | 3 |
|  |  | medium | moyen | mittel | medio | Boston (SC) | 5 |
|  |  | long | long | lang | largo | GH5704 (SC) | 7 |
| 35.   (+) | **75-79 VG** | Only varieties with ear type of grain: sweet: Grain: width | Seulement pour les variétés avec le type de grain de l’épi: doux: Grain: largeur | Nur Sorten mit Kolben: Korntyp: Zuckermais: Korn: Breite | Sólo variedades con mazorca con tipo de grano: dulce: Grano: anchura |  |  |
| **QN** | **(d)** | narrow | étroit | schmal | estrecho | Bonus (SC) | 3 |
|  |  | medium | moyen | mittel | medio | Jubilee (SC) | 5 |
|  |  | broad | large | breit | ancho | Mv. Aranyos (SC) | 7 |
| 36.  (\*) (+) | 92 (S) VG | Ear: type of grain | Épi: type de grain | Kolben: Korntyp | Mazorca: tipo de grano |  |  |
| **QL** | **(d)** | flint | corné | Hartmais | córneo | F2 | 1 |
|  | **(e)** | flint-like | corné à corné-denté | hartmaisähnlich | córneo a córneo-dentado | F252 | 2 |
|  |  | intermediate | corné-denté | Zwischentyp | córneo-dentado | F107 | 3 |
|  |  | dent-like | corné-denté à denté | zahnmaisähnlich | córneo-dentado a dentado | A654 | 4 |
|  |  | dent | denté | Zahnmais | dentado | W182E | 5 |
|  |  | sweet | sucré | Zuckermais | dulce | Jubilee (SC) | 6 |
|  |  | pop | à éclater | Popcorn | palomero | Iowa Pop (PC) | 7 |
|  |  | waxy | cireux | Wachsmais | ceroso |  | 8 |
|  |  | flour | farineux | Mehlmais | harinoso |  | 9 |
| **37.**  **(\*) (+)** | **92 VG** | **Only varieties with ear type of grain: sweet:**  **Ear: shrinkage of top of grain** | **Seulement variétés avec type de grain de l’épi: doux:** **Épi: rétrécissement de la partie supérieure du grain** | **Nur Sorten mit Kolben: Korntyp: Zuckermais: Kolben: Schrumpfung Kornkrone** | **Sólo variedades con mazorca con tipo de grano: dulce: Mazorca: contracción del extremo superior del grano** |  |  |
| **QN** | **(d)** | weak | faible | gering | débil | Zarja (SC) | 1 |
|  | **(e)** | medium | moyenne | mittel | media | Merkur (SC) | 3 |
|  |  | strong | forte | stark | fuerte | Dessert 73 (SC) | 5 |
| 38.  (\*) | 92-93 (S) VG | Ear: main color of top of grain | Épi: couleur principale du sommet du grain | Kolben: Hauptfarbe der Kornkrone | Mazorca: color principal del extremo superior del grano |  |  |
| **PQ** | **(d)** | white | blanc | weiß | blanco | A188,  Pure white (SC), Snowbelle (SC), Sugar Purple (SC) | 1 |
|  | **(e)** | yellowish white | blanc jaunâtre | gelblich weiß | blanco amarillento |  | 2 |
|  |  | yellow | jaune | gelb | amarillo | F259,  SSActivate (SC) | 3 |
|  |  | yellow orange | jaune orangé | gelborange | amarillo anaranjado | F2, Gyöngymazsola (SC) | 4 |
|  |  | orange | orange | orange | naranja | F257, GH 2547 (SC) | 5 |
|  |  | red orange | rouge orangé | rotorange | naranja rojizo | Dynasty (SC) | 6 |
|  |  | red | rouge | rot | rojo |  | 7 |
|  |  | purple | pourpre | purpur | púrpura | Dynared (SC), Wild Violet (SC) | 8 |
|  |  | brownish | brunâtre | bräunlich | amarronado | Zenith (SC) | 9 |
|  |  | bluish black | noir bleuâtre | bläulichschwarz | negro azulado | Miheukchal | 10 |
| **39. (\*) (+)** | **VG 92-93** | **Only for sweet, pop or waxy varieties with Ear: number of colors of grains: two: Ear: secondary color of top of grain** | **Seulement pour les variétés avec type de grain de l’épi: doux, à éclater ou cireux: Épi: nombre de couleurs de grains: Épi: couleur secondaire du sommet du grain** | **Nur Sorten mit Kolben: Korntyp: Zuckermais, Popcorn oder Wachsmais: Kolben: Anzahl Farben der Körner:** **Kolben: Sekundärfarbe der Kornkrone** | **Sólo variedades con mazorca con tipo de grano: dulce, palomero o ceroso: Mazorca: número de colores de los granos: Mazorca: color secundario del extremo superior del grano** |  |  |
| **PQ** |  | white | blanc | weiß | blanco | SSActivate (SC), Wild Violet (SC) | 1 |
|  |  | yellowish white | blanc jaunâtre | gelblich weiß | blanco amarillento |  | 2 |
|  |  | yellow | jaune | gelb | amarillo |  | 3 |
|  |  | yellow orange | jaune orangé | gelborange | amarillo anaranjado |  | 4 |
|  |  | orange | orange | orange | naranja |  | 5 |
|  |  | red orange | rouge orangé | rotorange | naranja rojizo |  | 6 |
|  |  | red | rouge | rot | rojo |  | 7 |
|  |  | purple | pourpre | purpur | púrpura | Sugar Purple (SC) | 8 |
|  |  | brownish | brunâtre | bräunlich | amarronado |  | 9 |
|  |  | bluish black | noir bleuâtre | bläulichschwarz | negro azulado |  | 10 |
| 40. (\*) | 92-93 (S) VG | Excluding varieties with ear type of grain: sweet: Ear: color of dorsal side of grain | À l’exclusion des variétés avec type de grain de l’épi: doux: Épi: couleur de la face dorsale du grain | Ohne Sorten mit Kolben: Korntyp: Zuckermais: Kolben: Farbe der Kornrückseite | Excepto variedades con mazorca con tipo de grano: dulce: Mazorca: color del lado dorsal del grano |  |  |
| **PQ** | **(d)** | white | blanc | weiß | blanco | F481 | 1 |
|  | **(e)** | yellowish white | blanc jaunâtre | gelblich weiß | blanco amarillento | A188 | 2 |
|  |  | yellow | jaune | gelb | amarillo |  | 3 |
|  |  | yellow orange | jaune orangé | gelborange | amarillo anaranjado | F66 | 4 |
|  |  | orange | orange | orange | naranja | EP1 | 5 |
|  |  | red orange | rouge orangé | rotorange | naranja rojizo |  | 6 |
|  |  | red | rouge | rot | rojo |  | 7 |
|  |  | purple | pourpre | purpurn | púrpura |  | 8 |
|  |  | brownish | brunâtre | bräunlich | amarronado |  | 9 |
|  |  | bluish black | noir bleuâtre | bläulichschwarz | negro azulado |  | 10 |
| 41.   (+) | 93 VG | Only varieties with ear type of grain: pop: Type of popped grain | Seulement pour les variétés avec le type de grain de l’épi: à éclater: Type de grain éclaté | Nur Sorten mit Kolben: Korntyp: Popcorn: Typ des gepufften Korns | Sólo variedades con mazorca con tipo de grano: palomero: Tipo del grano reventado |  |  |
| **QN** |  | butterfly | à ailettes | Schmetterlingtyp | palomita | Robust 97461 (PC) | 1 |
|  |  | intermediate | intermédiaire | Zwischentyp | intermedio |  | 2 |
|  |  | globular | globuleux | Kugeltyp | globular | Robust 90252 (PC) | 3 |
| 42. (\*) (+) | 93 (S) VG | Ear: anthocyanin coloration of glumes of cob | Épi: pigmentation anthocyanique des glumes de la rafle | Kolben: Anthocyan­färbung der Spelzen der Spindel | Mazorca: pigmentación antociánica de las glumas del zuro |  |  |
| **QN** |  | absent or very weak | nulle ou très faible | fehlend oder sehr gering | ausente o muy débil | F2, F257 | 1 |
|  |  | weak | faible | gering | débil | F252 | 3 |
|  |  | medium | moyenne | mittel | media | W117 | 5 |
|  |  | strong | forte | stark | fuerte | A632 | 7 |
|  |  | very strong | très forte | sehr stark | muy fuerte |  | 9 |

# 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) The observation should be made on the leaf just above upper ear.

(b) The observation should be made in the middle third of the main branch of the tassel.

(c) The observation should be made on the second branch from the bottom of the tassel.

(d) The observation should be made in the middle third of the uppermost ear, when well developed.

(e) This characteristic may be influenced by cross-pollination. In particular in sweetcorn and popcorn varieties, cross-pollination should be avoided.

## 8.2 Explanations for individual characteristics

Ad. 2: First leaf: shape of apex

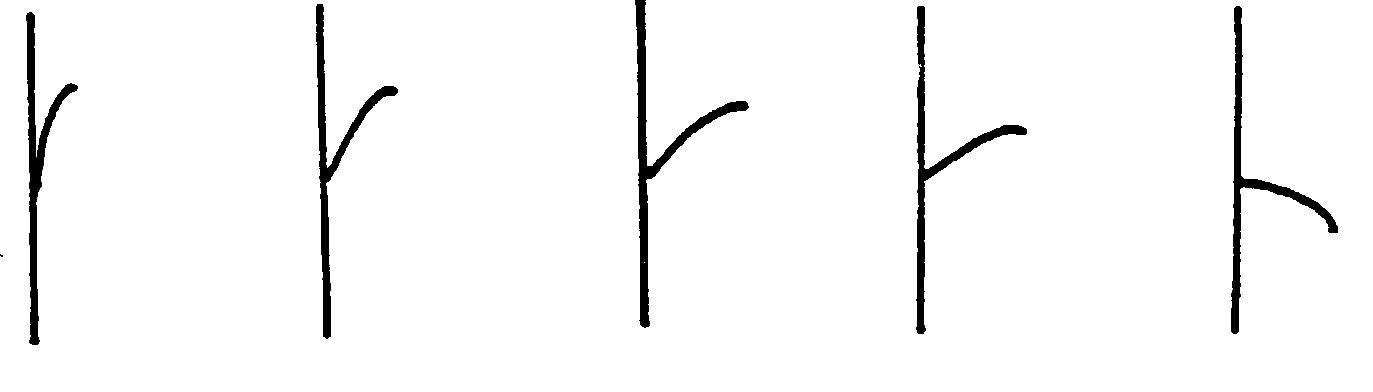
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | | | | |
| 1 | 2 | 3 | 4 | 5 |
| pointed | pointed to rounded | rounded | rounded to spatulate | spatulate |

Ad. 4: Leaf: undulation of margin of blade

|  |  |  |
| --- | --- | --- |
|  |  |  |
| 1 | 2 | 3 |
| absent or very weak | intermediate | strong |

Ad. 5: Leaf: angle between blade and stem

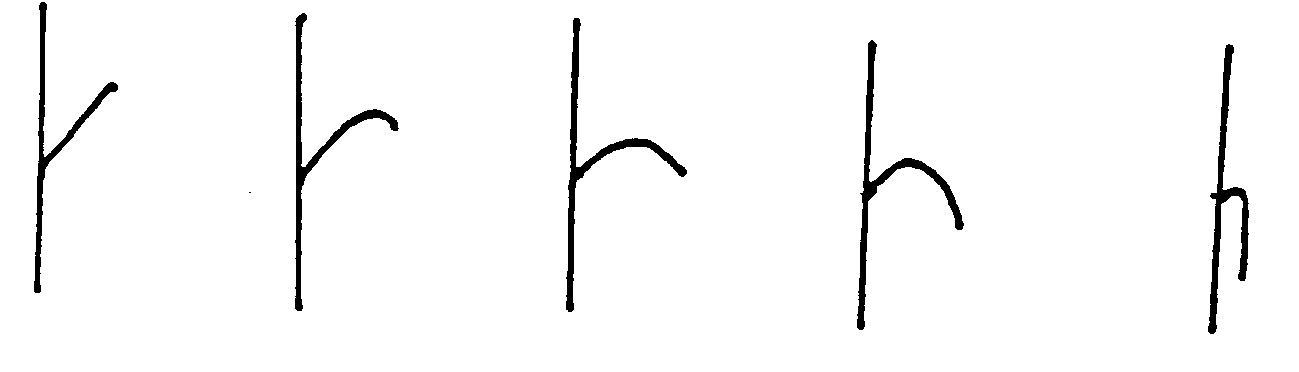
Ad. 12: Tassel: angle between main axis and lateral branches



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 3 | 5 | 7 | 9 |
| very small (< 5°) | small (+ 25°) | medium (+ 50°) | large (+ 75°) | very large (> 90°) |

Ad. 6: Leaf: curvature of blade

Ad. 13: Tassel: curvature of lateral branches



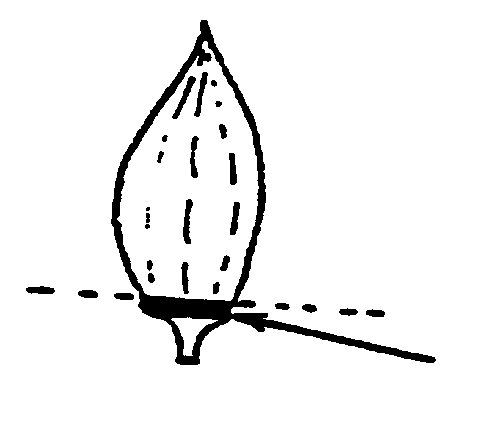
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1 | 3 | 5 | 7 | 9 |
| absent or very slightly recurved | slightly recurved | moderately recurved | strongly recurved | very strongly recurved |

Ad. 8: Tassel:  time of anthesis

The time of anthesis is when 50% of plants have anthers visible in the middle third of the main branch.

Ad. 9: Tassel: anthocyanin coloration at base of glume

Ad. 10: Tassel: anthocyanin coloration of glumes excluding base



base of glume

Ad. 11: Tassel: anthocyanin coloration of anthers

The observation should be made in the middle third of the main branch on fresh anthers.

Ad. 15: Ear: time of silk emergence

The time of silk emergence is when silks have emerged on 50% of plants.

Ad. 17: Stem: anthocyanin coloration of brace roots

The observation should be made when well developed and fresh brace roots are present on 50% of plants.

Ad. 19: Leaf: anthocyanin coloration of sheath

The observation should be made in the middle third of the plant.

Ad. 20: Stem: anthocyanin coloration of internodes

The observation should be made just above insertion point of peduncle of upper ear.

Ad. 21: Tassel: length of main axis above lowest lateral branch

Ad. 22: Tassel: length of main axis above highest lateral branch



Ad. 21

Ad. 22

Ad. 24.1: Only inbred lines: Plant: length

Ad. 24.2: Only hybrids and open-pollinated varieties: Plant: length

Ad. 25: Plant: ratio height of insertion of peduncle of upper ear to plant length

The plant length should be observed including the tassel.

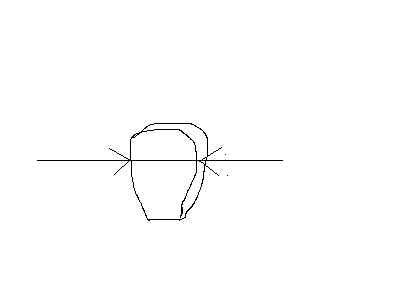
Ad. 28: Ear: length



Ad. 30: Ear: shape

|  |  |  |
| --- | --- | --- |
|  | | |
| 1 | 2 | 3 |
| conical | conico-cylindrical | cylindrical |

Ad. 35: Only varieties with ear type of grain: sweet:Grain: width



Ad. 36: Ear: type of grain

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | |  |  |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| flint | flint-like | intermediate | dent-like | dent | sweet | pop |

|  |  |  |
| --- | --- | --- |
| 1 | flint | mostly hard endosperm, round grain, thick layer of hard endosperm on crown, larger grains than pop |
| 2 | flint-like | mostly hard endosperm, round grain, intermediate layer of hard endosperm on crown |
| 3 | intermediate | thin layer of hard endosperm on crown, crown slightly indented |
| 4 | dent-like | mostly soft endosperm, crown moderately indented, medium layer of hard endosperm on dorsal side of grain, |
| 5 | dent | mostly soft endosperm covering also exterior part of crown, thin layer of hard endosperm only on dorsal side of grain, grain strongly indented on crown |
| 6 | sweet | glassy endosperm with very low or no starch content, wrinkled grain |
| 7 | pop | nearly completely hard endosperm, rice-type (pointed grain) or pearl type (rounded grain), very thick layer of hard endosperm on crown, smaller grains than flint |
| 8 | waxy | approximately 100 % amylopectine, waxy appearance of grain, pink coloration of endosperm in iodine staining test (bluish black coloration of other types of grain).  Iodine staining test    waxy non waxy |
| 9 | flour | completely soft endosperm, grain round or slightly indented on crown |

Ad. 37: Only varieties with ear type of grain: sweet:Ear: shrinkage of top of grain

|  |  |  |
| --- | --- | --- |
|  |  |  |
| 1 | 3 | 5 |
| weak | medium | strong |

Ad. 39: Only for sweet, pop or waxy varieties with Ear: number of colors of grains: two: Ear: secondary color of top of grain

The color with the largest surface area is the main color; the one with the second largest area is the secondary color.

In cases where the areas of the main and secondary color are too similar to reliably decide which color has the largest area, [the darkest color] is considered to be the main color.

Note: caution should be taken if no full isolation of varieties with different colors in the trial is practiced. Cross pollination from other samples can in that case cause small amounts of grain with a different color which do not belong to the variety. Hence the variety is not a variety with two colors (bicolor variety) of itself.

Ad. 41: Only varieties with ear type of grain: pop:Type of popped grain

Ears should be stored for a minimum of 2 or 3 months after harvest before popping.

The dry grains (13-13.5% water content is optimal) are popped with heating. The typical shape of the popped grains has to be observed.

|  |  |
| --- | --- |
|  |  |
| 1 | 3 |
| butterfly | globular |

Ad. 42: Ear: anthocyanin coloration of glumes of cob

The anthocyanin coloration should be observed on the middle third of the uppermost cob, after the removal of some of the grains.

8.3 Decimal Code for the Growth Stages\*

This decimal code is in close conformity with the BBCH-code (Meier, 1997)

CODE GENERAL DESCRIPTION DESCRIPTION

Seedling growth Croissance de la plantule Wachstum des Keimlings

14 4 leaves unfolded 4 feuilles étalées 4 Blätter entfaltet

Tillering Tallage Bestockung

Stem elongation Elongation de la tige Schossen

(montaison)

Booting Gonflement Schwellstadium

Inflorescence emergence Epiaison Erscheinen des

Blütenstands

51 Inflorescence just visible Inflorescence à peine Blütenstand gerade

visible sichtbar

59 Emergence of Inflorescence Blütenstand

inflorescence completed complètement dégagée vollständig geschoben

Anthesis Anthèse Blüte

61 Beginning of anthesis Début de l'anthèse Beginn der Blüte

65 Anthesis halfway Mi-floraison Mitte der Blüte

69 Anthesis complete Anthèse complete Ende der Blüte





Milk development Stade laiteux Entwicklung der Milchreife

71 Caryopsis watery ripe State aqueux de la Karyopse wasserreif

maturation du caryopse

73 Early milk début laiteux

75 Medium milk Mi-laiteux Mitte der Milchreife

79(1) Grains have reached Le grain a atteint Körner haben Endgröße

final size la taille finale erreicht

Dough development Stade pâteux Entwicklung der Teigreife

85 Soft dough Pâteux tendre weich teigreif

Ripening Maturation Das Reifen

92 Caryopsis hard (can no Le caryopse est dur Karyopse hart (nicht mehr

longer be dented by (ne peut plus du tout mit dem Daumennagel thumbnail) être entamé par l'ongle) einzudellen)

93 Caryopsis loosening Caryopse se détachant Karyopse tagsüber

in daytime dans la journée lockernd

\* Extracted from J.C. Zadoks, T.T. Chang and C.F. Konzak except (1), Decimal Code for the Growth States of Cereals, EUCARPIA Bulletin No. 7, 1974, pp. 42-52. The French translation has been kindly furnished by Mrs. R. Cassini, Mr. R. Cassini and Mr. R. Marie. The German translation has been kindly furnished by Mr. A.O. Klomp and Mrs. I. Volk.

\* Extrait de J.C. Zadoks, T.T. Chang et C.F. Konzak excepté (1), Decimal Code for the Growth States of Cereals, EUCARPIA Bulletin No. 7, 1974, pp. 42-52. La traduction française a été aimablement fournie par Mme R. Cassini, M. R. Cassini et M. R. Marie. La traduction allemande a été aimablement fournie par M. A.O. Klomp et Mme I. Volk.

\* Auszug von J.C. Zadoks, T.T. Chang und C.F. Konzak außer (1), Decimal Code for the Growth States of Cereals, EUCARPIA Bulletin No. 7, 1974, pp. 42-52. Die französische Übersetzung wurde freundlicherweise von Frau R. Cassini, Herrn R. Cassini und Herrn R. Marie überlassen. Die deutsche Uebersetzung wurde freundlicherweise von Herrn A.O. Klomp und Frau I. Volk überlassen.

\* Extraído de J.C. Zadoks, T.T. Chang y C.F. Konzak excepto (1), Decimal Code for the Growth States of Cereals, EUCARPIA Bulletin No. 7, 1974, pp. 42-52. La traducción al francés ha sido facilitada amablemente por la Sra. R. Cassini, el Sr. R. Cassini y el Sr. R. Marie. La traducción al alemán ha sido facilitada amablemente por el Sr. A.O. Klomp y la Sra. I. Volk.

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# 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 | | | | | *Zea mays* L. | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
| 1.2 Common name | | | | | Maize | | | | | | | | |  | | |
|  | | | | | | | | | | | | | | | | |
| 2. Applicant | | | | | | | | | | | | | | | | |
|  | | | | |  | | | | | | | | |  | | |
| Name | | | | |  | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
| Address | | | | |  | | | | | | | | |  | | |
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| Telephone No. | | | | |  | | | | | | | | |  | | |
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| Fax No. | | | | |  | | | | | | | | |  | | |
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| E-mail address | | | | |  | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
| Breeder (if different from applicant) | | | | | | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
| 3. Proposed denomination and breeder’s reference | | | | | | | | | | | | | | | | |
|  | | | | |  | | | | | | | | |  | | |
| Proposed denomination | | | | |  | | | | | | | | |  | | |
| (if available) | | | | |  | | | | | | | | |  | | |
| Breeder’s reference | | | | |  | | | | | | | | |  | | |
|  | | | | |  | | | | | | | | |  | | |
| [[3]](#footnote-3)#4. Information on the breeding scheme and propagation of the variety  4.1 Breeding scheme  (i) Inbred line [ ]  (ii) Single-cross hybrid [ ]  (iii) Three-way cross hybrid [ ]  (iv) Double-cross hybrid [ ]  (v) Open-pollinated variety [ ]  (vi) Other (provide details) [ ]  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]](#footnote-4)##4.2.1 In the case of hybrid varieties the production scheme should be provided. This should provide details of all the parent lines required for propagating the hybrid e.g.  *(a) Single Hybrid*  (….....................................................…) x (….....................................................…)  female parent line male parent line  *(b) Three-Way Hybrid*  single hybrid (below) used as female parent x (….....................................................…)  male parent line  or (……..................................................…) x single hybrid (below) used as male parent  female parent line    (….....................................................…) x (….....................................................…)  female parent line male parent line  *single hybrid*  *(c) Double Hybrid*  (….....................................................…) x (….....................................................…)  female parent line male parent line  *single hybrid used as female parent*  (….....................................................…) x (….....................................................…)  female parent line male parent line  *single hybrid used as male parent*  (single hybrid used as female parent) x (single hybrid used as male parent)  and should identify in particular:  (i) any male sterile female parent lines  ……………………………………  (ii) maintenance system of male sterile female parent lines | | | | | | | | | | | | | | | | |
| 4.2.2 Open-pollinated variety (please provide details)  …………………………………………………  4.2.3 Other (please provide details)  ………………………………………………… | | | | | | | | | | | | | | | | |
| 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 (8)** | | | **Tassel: time of anthesis** | | | | | | | |  | | | |  | | |
|  | | | very early | | | | | | | |  | | | | 1 [ ] | | |
|  | | | very early to early | | | | | | | | KW1069, Spirit (SC) | | | | 2 [ ] | | |
|  | | | early | | | | | | | | Champ (SC), F257 | | | | 3 [ ] | | |
|  | | | early to medium | | | | | | | | Centurion (SC), F259 | | | | 4 [ ] | | |
|  | | | medium | | | | | | | | F522, Zenith (SC) | | | | 5 [ ] | | |
|  | | | medium to late | | | | | | | | A632 | | | | 6 [ ] | | |
|  | | | late | | | | | | | | B73 | | | | 7 [ ] | | |
|  | | | late to very late | | | | | | | | AM1513 | | | | 8 [ ] | | |
|  | | | very late | | | | | | | |  | | | | 9 [ ] | | |
| **5.2 (9)** | | | **Tassel: anthocyanin coloration at base of glume** | | | | | | | |  | | | |  | | |
|  | | | absent or very weak | | | | | | | | Royalty (SC), W117 | | | | 1[ ] | | |
|  | | | very weak to weak | | | | | | | |  | | | | 2[ ] | | |
|  | | | weak | | | | | | | | Boston (SC), F66 | | | | 3[ ] | | |
|  | | | weak to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | F107 | | | | 5[ ] | | |
|  | | | medium to strong | | | | | | | |  | | | | 6[ ] | | |
|  | | | strong | | | | | | | | EP1 | | | | 7[ ] | | |
|  | | | strong to very strong | | | | | | | |  | | | | 8[ ] | | |
|  | | | very strong | | | | | | | |  | | | | 9[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.3 (10)** | | | **Tassel: anthocyanin coloration of glumes excluding base** | | | | | | | |  | | | |  | | |
|  | | | absent or very weak | | | | | | | | Empire (SC), F259 | | | | 1[ ] | | |
|  | | | very weak to weak | | | | | | | |  | | | | 2[ ] | | |
|  | | | weak | | | | | | | | F2, Royalty (SC) | | | | 3[ ] | | |
|  | | | weak to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | Centurion (SC), WD36 | | | | 5[ ] | | |
|  | | | medium to strong | | | | | | | |  | | | | 6[ ] | | |
|  | | | strong | | | | | | | | W79A | | | | 7[ ] | | |
|  | | | strong to very strong | | | | | | | |  | | | | 8[ ] | | |
|  | | | very strong | | | | | | | |  | | | | 9[ ] | | |
| **5.4 (11)** | | | **Tassel: anthocyanin coloration of anthers** | | | | | | | |  | | | |  | | |
|  | | | absent or very weak | | | | | | | | A654, Empire (SC) | | | | 1[ ] | | |
|  | | | very weak to weak | | | | | | | |  | | | | 2[ ] | | |
|  | | | weak | | | | | | | | F2, Royalty (SC) | | | | 3[ ] | | |
|  | | | weak to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | Centurion (SC), W182E | | | | 5[ ] | | |
|  | | | medium to strong | | | | | | | |  | | | | 6[ ] | | |
|  | | | strong | | | | | | | |  | | | | 7[ ] | | |
|  | | | strong to very strong | | | | | | | |  | | | | 8[ ] | | |
|  | | | very strong | | | | | | | |  | | | | 9[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.5 (14)** | | | **Tassel: number of primary lateral branches** | | | | | | | |  | | | |  | | |
|  | | | absent or very few | | | | | | | | F7 | | | | 1[ ] | | |
|  | | | very few to few | | | | | | | |  | | | | 2[ ] | | |
|  | | | few | | | | | | | | F252, Mv. Aranyos (SC) | | | | 3[ ] | | |
|  | | | few to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | F244, Kokanee (SC) | | | | 5[ ] | | |
|  | | | medium to many | | | | | | | |  | | | | 6[ ] | | |
|  | | | many | | | | | | | | A188, Zenith (SC) | | | | 7[ ] | | |
|  | | | many to very many | | | | | | | |  | | | | 8[ ] | | |
|  | | | very many | | | | | | | | Suregold (SC) | | | | 9[ ] | | |
| **5.6 (15)** | | | **Ear: time of silk emergence** | | | | | | | |  | | | |  | | |
|  | | | very early | | | | | | | | Mv. Aranyos (SC) | | | | 1[ ] | | |
|  | | | very early to early | | | | | | | | KW1069, Spirit (SC) | | | | 2[ ] | | |
|  | | | early | | | | | | | | Champ (SC), F257 | | | | 3[ ] | | |
|  | | | early to medium | | | | | | | | F259, Royalty (SC) | | | | 4[ ] | | |
|  | | | medium | | | | | | | | Bonus (SC), F522 | | | | 5[ ] | | |
|  | | | medium to late | | | | | | | | A632 | | | | 6[ ] | | |
|  | | | late | | | | | | | | B73 | | | | 7[ ] | | |
|  | | | late to very late | | | | | | | | AM1513 | | | | 8[ ] | | |
|  | | | very late | | | | | | | |  | | | | 9[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.7 (16)** | | | **Ear: anthocyanin coloration of silks** | | | | | | | |  | | | |  | | |
|  | | | absent or very weak | | | | | | | | Bonus (SC), F7, F195 | | | | 1[ ] | | |
|  | | | very weak to weak | | | | | | | |  | | | | 2[ ] | | |
|  | | | weak | | | | | | | | El Toro (SC), F257 | | | | 3[ ] | | |
|  | | | weak to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | F244, Gyöngymazsola (SC) | | | | 5[ ] | | |
|  | | | medium to strong | | | | | | | |  | | | | 6[ ] | | |
|  | | | strong | | | | | | | | W401 | | | | 7[ ] | | |
|  | | | strong to very strong | | | | | | | |  | | | | 8[ ] | | |
|  | | | very strong | | | | | | | |  | | | | 9[ ] | | |
| **5.8 i (24.1)** | | | **Only inbred lines:** **Plant: length** | | | | | | | |  | | | |  | | |
|  | | | very short | | | | | | | | F7 | | | | 1[ ] | | |
|  | | | very short to short | | | | | | | |  | | | | 2[ ] | | |
|  | | | short | | | | | | | | W117 | | | | 3[ ] | | |
|  | | | short to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | F244 | | | | 5[ ] | | |
|  | | | medium to long | | | | | | | |  | | | | 6[ ] | | |
|  | | | long | | | | | | | | WD36 | | | | 7[ ] | | |
|  | | | long to very long | | | | | | | |  | | | | 8[ ] | | |
|  | | | very long | | | | | | | |  | | | | 9[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.~~4~~ 8 ii (24.2)** | | | **Only hybrids and open-pollinated varieties:** **Plant: length** | | | | | | | |  | | | |  | | |
|  | | | very short | | | | | | | |  | | | | 1[ ] | | |
|  | | | very short to short | | | | | | | |  | | | | 2[ ] | | |
|  | | | short | | | | | | | | PR39D23, Spirit (SC) | | | | 3[ ] | | |
|  | | | short to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | PR37Y12, Puma (SC) | | | | 5[ ] | | |
|  | | | medium to long | | | | | | | |  | | | | 6[ ] | | |
|  | | | long | | | | | | | | DKC5166,  Royalty (SC) | | | | 7[ ] | | |
|  | | | long to very long | | | | | | | |  | | | | 8[ ] | | |
|  | | | very long | | | | | | | | Enterprise (SC) | | | | 9[ ] | | |
| **5.9 (28)** | | | **Ear: length** | | | | | | | |  | | | |  | | |
|  | | | very short | | | | | | | |  | | | | 1[ ] | | |
|  | | | very short to short | | | | | | | |  | | | | 2[ ] | | |
|  | | | short | | | | | | | | F2 | | | | 3[ ] | | |
|  | | | short to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | A654, Spirit (SC) | | | | 5[ ] | | |
|  | | | medium to long | | | | | | | |  | | | | 6[ ] | | |
|  | | | long | | | | | | | | Empire (SC), MO17 | | | | 7[ ] | | |
|  | | | long to very long | | | | | | | |  | | | | 8[ ] | | |
|  | | | very long | | | | | | | |  | | | | 9[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.10 (29)** | | | **Ear: diameter (in middle)** | | | | | | | |  | | | |  | | |
|  | | | very small | | | | | | | |  | | | | 1[ ] | | |
|  | | | very small to small | | | | | | | |  | | | | 2[ ] | | |
|  | | | small | | | | | | | | F7 | | | | 3[ ] | | |
|  | | | small to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | W117 | | | | 5[ ] | | |
|  | | | medium to large | | | | | | | |  | | | | 6[ ] | | |
|  | | | large | | | | | | | | Centurion (SC), F481 | | | | 7[ ] | | |
|  | | | large to very large | | | | | | | |  | | | | 8[ ] | | |
|  | | | very large | | | | | | | | Empire (SC) | | | | 9[ ] | | |
| **5.11 (30)** | | | **Ear: shape** | | | | | | | |  | | | |  | | |
|  | | | conical | | | | | | | | F16, Wombat (SC) | | | | 1[ ] | | |
|  | | | conico-cylindrical | | | | | | | | Centurion (SC), F816 | | | | 2[ ] | | |
|  | | | cylindrical | | | | | | | | F66, GH2547 (SC) | | | | 3[ ] | | |
| **5.12 (31)** | | | **Ear: number of rows of grain** | | | | | | | |  | | | |  | | |
|  | | | very few | | | | | | | |  | | | | 1[ ] | | |
|  | | | very few to few | | | | | | | |  | | | | 2[ ] | | |
|  | | | few | | | | | | | | F257 | | | | 3[ ] | | |
|  | | | few to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | Dessert 73 (SC), F16 | | | | 5[ ] | | |
|  | | | medium to many | | | | | | | |  | | | | 6[ ] | | |
|  | | | many | | | | | | | | B73, Bonus (SC) | | | | 7[ ] | | |
|  | | | many to very many | | | | | | | |  | | | | 8[ ] | | |
|  | | | very many | | | | | | | |  | | | | 9[ ] | | |
| **5.13 (32)** | | | **Only varieties with ear type of grain: sweet, pop, or waxy: Ear: number of colors of grains** | | | | | | | |  | | | |  | | |
|  | | | one | | | | | | | | Jubilee (SC) | | | | 1[ ] | | |
|  | | | two | | | | | | | | Eolrukchal-ilho, Serendipity (SC) | | | | 2[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.14 (33)** | | | **Only varieties with ear type of grain: sweet: Grain: intensity of yellow color** | | | | | | | |  | | | |  | | |
|  | | | very light | | | | | | | |  | | | | 1[ ] | | |
|  | | | very light to light | | | | | | | |  | | | | 2[ ] | | |
|  | | | light | | | | | | | | Gyöngymazsola (SC) | | | | 3[ ] | | |
|  | | | light to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | Royalty (SC) | | | | 5[ ] | | |
|  | | | medium to dark | | | | | | | |  | | | | 6[ ] | | |
|  | | | dark | | | | | | | | Kokanee (SC) | | | | 7[ ] | | |
|  | | | dark to very dark | | | | | | | |  | | | | 8[ ] | | |
|  | | | very dark | | | | | | | |  | | | | 9[ ] | | |
| **5.15 (35)** | | | **Only varieties with ear type of grain: sweet: Grain: width** | | | | | | | |  | | | |  | | |
|  | | | very narrow | | | | | | | |  | | | | 1[ ] | | |
|  | | | very narrow to narrow | | | | | | | |  | | | | 2[ ] | | |
|  | | | narrow | | | | | | | | Bonus (SC) | | | | 3[ ] | | |
|  | | | narrow to medium | | | | | | | |  | | | | 4[ ] | | |
|  | | | medium | | | | | | | | Jubilee (SC) | | | | 5[ ] | | |
|  | | | medium to broad | | | | | | | |  | | | | 6[ ] | | |
|  | | | broad | | | | | | | | Mv. Aranyos (SC) | | | | 7[ ] | | |
|  | | | broad to very broad | | | | | | | |  | | | | 8[ ] | | |
|  | | | very broad | | | | | | | |  | | | | 9[ ] | | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | Note | | |
| **5.16 (36)** | | | **Ear: type of grain** | | | | | | | |  | | | |  | | |
|  | | | flint | | | | | | | | F2 | | | | 1 [ ] | | |
|  | | | flint-like | | | | | | | | F252 | | | | 2 [ ] | | |
|  | | | intermediate | | | | | | | | F107 | | | | 3 [ ] | | |
|  | | | dent-like | | | | | | | | A654 | | | | 4 [ ] | | |
|  | | | dent | | | | | | | | W182E | | | | 5 [ ] | | |
|  | | | sweet | | | | | | | | Jubilee (SC) | | | | 6 [ ] | | |
|  | | | pop | | | | | | | | Iowa Pop (PC) | | | | 7 [ ] | | |
|  | | | waxy | | | | | | | |  | | | | 8 [ ] | | |
|  | | | flour | | | | | | | |  | | | | 9 [ ] | | |
| **5.17 (37)** | | | **Only varieties with ear type of grain: sweet: Ear: shrinkage of top of grain** | | | | | | | |  | | | | |  | |
|  | | | weak | | | | | | | | Zarja (SC) | | | | | 1[ ] | |
|  | | | weak to medium | | | | | | | |  | | | | | 2[ ] | |
|  | | | medium | | | | | | | | Merkur (SC) | | | | | 3[ ] | |
|  | | | medium to strong | | | | | | | |  | | | | | 4[ ] | |
|  | | | strong | | | | | | | | Dessert 73 (SC) | | | | | 5[ ] | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | | Note | |
| **5.18 (38)** | | | **Ear: main color of top of grain** | | | | | | | |  | | | | |  | |
|  | | | white | | | | | | | | A188,  Pure white (SC), Snowbelle (SC), Sugar Purple (SC) | | | | | 1 [ ] | |
|  | | | yellowish white | | | | | | | |  | | | | | 2 [ ] | |
|  | | | yellow | | | | | | | | F259,  SSActivate (SC) | | | | | 3 [ ] | |
|  | | | yellow orange | | | | | | | | F2,  Gyöngymazsola (SC) | | | | | 4 [ ] | |
|  | | | orange | | | | | | | | F257, GH 2547 (SC) | | | | | 5 [ ] | |
|  | | | red orange | | | | | | | | Dynasty (SC) | | | | | 6 [ ] | |
|  | | | red | | | | | | | |  | | | | | 7 [ ] | |
|  | | | purple | | | | | | | | Dynared (SC),  Wild Violet (SC) | | | | | 8 [ ] | |
|  | | | brownish | | | | | | | | Zenith (SC) | | | | | 9 [ ] | |
|  | | | bluish black | | | | | | | | Miheukchal | | | | | 10 [ ] | |
| **5.19 (39)** | | | **Only for sweet, pop or waxy varieties with Ear: number of colors of grains: two: Ear: secondary color of top of grain** | | | | | | | |  | | | | |  | |
|  | | | white | | | | | | | | SSActivate (SC), Wild Violet (SC) | | | | | 1 [ ] | |
|  | | | yellowish white | | | | | | | |  | | | | | 2 [ ] | |
|  | | | yellow | | | | | | | |  | | | | | 3 [ ] | |
|  | | | yellow orange | | | | | | | |  | | | | | 4 [ ] | |
|  | | | orange | | | | | | | |  | | | | | 5 [ ] | |
|  | | | red orange | | | | | | | |  | | | | | 6 [ ] | |
|  | | | red | | | | | | | |  | | | | | 7 [ ] | |
|  | | | purple | | | | | | | | Sugar Purple (SC) | | | | | 8 [ ] | |
|  | | | brownish | | | | | | | |  | | | | | 9 [ ] | |
|  | | | bluish black | | | | | | | |  | | | | | 10 [ ] | |
|  | | | Characteristics | | | | | | | | Example Varieties | | | | | Note | |
| **5.20 (40)** | | | **Excluding varieties with ear type of grain: sweet: Ear: color of dorsal side of grain** | | | | | | | |  | | | | |  | |
|  | | | white | | | | | | | | F481 | | | | 1 [ ] | | |
|  | | | yellowish white | | | | | | | | A188 | | | | 2 [ ] | | |
|  | | | yellow | | | | | | | |  | | | | 3 [ ] | | |
|  | | | yellow orange | | | | | | | | F66 | | | | 4 [ ] | | |
|  | | | orange | | | | | | | | EP1 | | | | 5 [ ] | | |
|  | | | red orange | | | | | | | |  | | | | 6 [ ] | | |
|  | | | red | | | | | | | |  | | | | 7 [ ] | | |
|  | | | purple | | | | | | | |  | | | | 8 [ ] | | |
|  | | | brownish | | | | | | | |  | | | | 9 [ ] | | |
|  | | | bluish black | | | | | | | |  | | | | 10 [ ] | | |
| **5.21 (42)** | | | **Ear: anthocyanin coloration of glumes of cob** | | | | | | | |  | | | |  | | |
|  | | | absent or very weak | | | | | | | | F2, F257 | | | | 1 [ ] | | |
|  | | | very weak to weak | | | | | | | |  | | | | 2 [ ] | | |
|  | | | weak | | | | | | | | F252 | | | | 3 [ ] | | |
|  | | | weak to medium | | | | | | | |  | | | | 4 [ ] | | |
|  | | | medium | | | | | | | | W117 | | | | 5 [ ] | | |
|  | | | medium to strong | | | | | | | |  | | | | 6 [ ] | | |
|  | | | strong | | | | | | | | A632 | | | | 7 [ ] | | |
|  | | | strong to very strong | | | | | | | |  | | | | 8 [ ] | | |
|  | | | very strong | | | | | | | |  | | | | 9 [ ] | | |
| 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* | | | | *Ear: time of silk emergence* | | | *early* | | | | | *early to medium* | | | | |
|  | | | |  | | |  | | | | |  | | | | |
|  | | | |  | | |  | | | | |  | | | | |
|  | | | |  | | |  | | | | |  | | | | |
| Comments: | | | | | | | | | | | | | | | | |
| [[5]](#footnote-5)#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 | | | | | | | | | | | | | | | | |
| Sweetcorn varieties only: type | | | | | | | |  | | | | |  | | | |
|  | normal sweet (su1) | | | | | | | Jubilee (SC) | | | | | 1 [ ] | | | |
|  | sugary enhanced (se) | | | | | | | Gyöngymazsola (SC) | | | | | 2 [ ] | | | |
|  | super sweet (sh2) | | | | | | | Zenith (SC) | | | | | 3 [ ] | | | |
|  | other (please specify) | | | | | | |  | | | | | 4 [ ] | | | |
| Other information | | | | | | | | | | | | | | | | |
| 8. Authorization for release  TO BE PROVIDED BY REP. OF KOREA: DR. CHOI  (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”.  …………………………………………………………… | | | | | | | | | | | | | | | | |
| 10. I hereby declare that, to the best of my knowledge, the information provided in this form is correct:  Applicant’s name  Signature Date | | | | | | | | | | | | | | | | |

[Annex follows]

# ANNEX

Additional Useful Explanations

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**Part I**

**Introduction**

The following Annex contains a list of characteristics based on isozyme markers revealed by electrophoresis and a description of the method to be used. UPOV decided to place these characteristics in an Annex to the Test Guidelines, thereby creating a special category of characteristic, because the majority of the UPOV member States is of the view that it is not possible to establish distinctness solely on the basis of a difference found in a characteristic based on isozyme markers revealed by electrophoresis. Such characteristics should therefore only be used as a complement to other differences in morphological or physiological characteristics. UPOV reconfirms that these characteristics are considered useful but that they might not be sufficient on their own to establish distinctness. They should not be used as a routine characteristic but at the request or with the agreement of the applicant of the candidate variety.

For the analysis of isozymes, starch gel electrophoresis is recommended. Polymorphism of isozymes (i.e. 16 enzyme loci) can be detected. Genetic control is known for each enzyme locus. For the description of the method and the genetic interpretation of the zymograms, reference is made to the technical bulletin by Stuber, Wendel, Goodman and Smith, 1988, and the technical handbook by Grenèche and Giraud, 1994. The alleles are described by band numbers according to the definition given by Cardy, Stuber, Goodman, 1980, (see Chapter IX, Literature).

**Part II**

**Characteristics derived by Isozyme Polymorphism**

|  | | **Characteristics** | |  | | **Examples** | | **Note** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **42.  QL** | | **Allele expression at locus Mdh 1** | | Genotype 1/1  Genotype 0.5/0.5  Genotype 0.5/1  Genotype 1/6 in interaction with allele 6 of Mdh 2  Genotype 0.5/6 in interaction with allele 6 of Mdh 2 | | F252  R3126  KW 5361 xKW 5454  Tau  Clarica | | 1 | | |
|  | |  | | Genotype 6/6 | | A239 | | 2 | | |
|  | |  | | Genotype 1/6 but not in interaction with allele 6 of Mdh 2  Genotype 0.5/6 but not in interaction with allele 6 of Mdh 2 | | Marshall  DK231 | | 3 | | |
| **43.  QL** | | **Allele expression at  locus Mdh 2** | | Genotype 3/3  Genotype 3.5/3.5  Genotype 3/3.5  Genotype 3/4.5  Genotype 3.5/4.5 | | F252  R3126  Limit, DK 231  Robin | | 1 | | |
|  | |  | | Genotype 4.5/4.5 | | W401 | | 2 | | |
|  | |  | | Genotype 6/6 | | A239 | | 3 | | |
|  | |  | | Genotype 3/6  Genotype 3.5/6 | | Azur  Clarica | | 4 | | |
|  | |  | | Genotype 4.5/6 | |  | | 5 | | |
| **44.** | | **Allele expression at locus Mdh 3** | | Genotype 16/16 | | F252 | | 1 | | |
| **QL** | |  | | Genotype 18/18 | | CO 158 | | 2 | | |
|  | |  | | Genotype 16/18 | | Figaro | | 3 | | |
| **45.** | | **Allele expression at locus Mmm** | | Genotype M/M  Genotype M/m | | F252 | | 1 | | |
| **QL** | |  | | Genotype m/m | | 86 N 42 | | 2 | | |
| **46.** | | **Allele expression at loci Mdh 4 + Mdh 5** | | Genotype 12/12 +12/12 | | F252 | | 1 | | |
| **QL** | |  | | Genotype 12/12 + 15/15  Genotype 12/12 + 12/15 | | F 2  Robin | | 2 | | |
| **47.** | | **Allele expression at loci Idh1 + Idh 2** | | Genotype 4/4 + 4/4  Genotype 4/6 + 4/4 | | A239 | | 1 |
| **QL** | |  | | Genotype 4/4 + 6/6 | | CM7 | | 2 |
|  | |  | | Genotype 6/6 + 4/4 | | F1110 | | 3 |
|  | |  | | Genotype 6/6 + 6/6  Genotype 4/6 + 6/6 | | CO 158 Bonny | | 4 |
|  | |  | | Genotype 4/4 + 4/6  Genotype 4/6 + 4/6 | | Axon  Loft | | 5 |
|  | |  | | Genotyp 6/6 + 4/6 | |  | | 6 |
| **48.** | | **Allele expression at loci Pgd 1 + Pgd2** | | Genotype 2/2 + 5/5 | | W401 | | 1 |
| **QL** | |  | | Genotype 2/2 + 2.8/2.8  Genotype 2/2 + n/n | | SK 203 | | 2 |
|  | |  | | Genotype 3.8/3.8 + 2.8/2.8  Genotype 3.8/3.8 +n/n | | A632 | | 3 |
|  | |  | | Genotype 3.8/3.8 + 5/5  Genotype 3.8/3.8 + 2.8/5  Genotype n/3.8 + 5/5 | | F252  Tekila | | 4 |
|  | |  | | Genotype n/n + 5/5 | | H108 | | 5 |
|  | |  | | Genotype 2/3.8 + 5/5  Genotype 2/3.8 + 2.8/5 | | Bekefix  Furio | | 6 |
|  | |  | | Genotype 2/2 + 2.8/5 | | NX 6032 | | 7 |
| **49.** | | ***Allele expression at loci Pgm 1 + Pgm2*** | | Genotype 9/9 + 1/1 | | F 2 | | 1 |
| **PQ** | |  | | Genotype 9/9 + 1/3 | | Robin | | 2 |
|  | |  | | Genotype 9/9 + 3/3 | | F 16 | | 3 |
|  | |  | | Genotype 9/9 + 3/4 | | Figaro | | 4 |
|  | |  | | Genotype 9/9 + 4/4 | | A 632 | | 5 |
|  | |  | | Genotype 9/9 + 1/4 | | Axon | | 6 |
|  | |  | | Genotype 9/9 + 8/8 | | MO 17 | | 7 |
|  | |  | | Genotype 9/9 + 3/8 | |  | | 8 |
|  | |  | | Genotype 9/9 + 4/8 | | Occitan | | 9 |
|  | |  | | Genotype 9/9 + 1/8 | |  | | 10 |
|  | |  | | Genotype 16/16 + 1/1 | |  | | 11 |
|  | |  | | Genotype 16/16 + 1/3 | |  | | 12 |
|  | |  | | Genotype 16/16 + 3/3 | | 9034 | | 13 |
|  | |  | | Genotype 16/16 + 4/4 | |  | | 14 |
|  | |  | | Genotype 16/16 + 8/8 | | F 492 | | 15 |
|  | |  | | Genotype 5/5+3/3 | | D 06 | | 16 |
| **50.** | | **Allele expression at locus Pgi 1** | | Genotype 4/4 | | A239 | | 1 |
| **QL** | |  | | Genotype 5/5 | | A632 | | 2 |
|  | |  | | Genotype 4/5 | | Artist | | 3 |
| **51.** | | **Allele expression at locus Acp1** | | Genotype 2/2 | | F 2 | | 1 |
| **PQ** | |  | | Genotype 2/3 | | Azur | | 2 |
|  | |  | | Genotype 3/3 | | A 239 | | 3 |
|  | |  | | Genotype 4/6 | | Contessa | | 4 |
|  | |  | | Genotype 4/4 | | A 632 | | 5 |
|  | |  | | Genotype 6/6 | | F 1444 | | 6 |
|  | |  | | Genotype 2/4 | | Occitan | | 7 |
|  | |  | | Genotype 2/6 | |  | | 8 |
|  | |  | | Genotype 3/4 | | Marshall | | 9 |
|  | |  | | Genotype 3/6 | |  | | 10 |
| **52.** | | **Allele expression at locus Dia 1** | | Genotype 8/8 | | F 2 | | 1 |
| **QL** | |  | | Genotype 12/12 | | CO 158 | | 2 |
|  | |  | | Genotype 8/12 | | Bastion | | 3 |
| **53.  QL** | | **Allele expression at locus Dia2** | | Genotype 4/4  Genotype 6/6  Genotype 4/6 | | F 2  34 M838  31 N 6 | | 1  2  3 |
| **54.** | | **Allele expression at locus Adh 1** | | Genotype 4/4 | | F 1444 | | 1 |
| **QL** | |  | | Genotype 6/6 | | F 2 | | 2 |
|  | |  | | Genotype 4/6 | | Bristol | | 3 |

**Part III**

**Description of the SGE Method for the**

**Analysis of Isozymes from *Zea mays* L.**

1. Number of coleoptiles per test

- for checking formula: at least 20 coleoptiles of each inbred line

2 coleoptiles of single-cross hybrids

6 coleoptiles of three-way cross hybrids

- for distinctness, uniformity and stability test: at least 20 coleoptiles for inbred

lines, hybrids and open-pollinated varieties.

2. Apparatus and equipment

Any suitable horizontal electrophoresis system can be used, provided that the gels can be kept at 4°C. A gel thickness of 10 mm is recommended. The power supply used should be capable of delivering constant voltage output.

3. Chemicals

All chemicals should be of 'Analytical Reagent' grade or better.

3.1 Chemicals for enzyme extraction

L-Ascorbic acid

L-Ascorbic acid Na salt

Sucrose

3.2 Chemicals for electrophoresis

Bromophenol blue

Citric acid monohydrate

L-Histidine

Starch hydrolyzed, for electrophoresis,)

3.3 Chemicals for staining enzymes

Acetic acid glacial

2,6-Dichlorophenol-indophenol Na salt

Ethanol

Ethylenediamine tetra-acetic acid Na2 Salt (EDTA)

Fast Garnet GBC salt

D-Fructose 6-phosphate Na2 salt

Glucose 1-phosphate dehydrogenase (Serva 22820 or 22822 or Sigma G5885)

Hydrochloric acid (HCl)

DL-Isocitric acid Na3 salt

Magnesium chloride hexahydrate

DL-Malic acid

Dimethylthiazol diphenyl tetrazolium (MTT)

β -Nicotinamide adenine dinucleotide (NAD)

β -Nicotinamide adenine dinucleotide reduced (NADH)

β -Nicotinamide adenine dinucleotide phosphate (NADP)

Nitro-blue tetrazolium (NBT)

Sodium hydroxide (NaOH)

1-Naphtyl acid phosphate

6-phosphogluconic acid Na3 salt dihydrate

Phenazine methosulfate (PMS)

Polyvinylpyrrolidone 40 (PVP-40)

Sodium acetate trihydrate

Tris-(hydroxymethyl) aminomethane (Tris)

4. Solutions

4.1 Extraction solution

16.7 g Sucrose

8.3 g sodium ascorbate

made up to 100 ml with de-ionised water and adjusted to pH 7.4 with L-ascorbic acid.

4.2 Electrophoresis buffers

4.2.1 Buffers for SGE pH 6.5

4.2.1.1 Stock solution : 0.364 M L-histidine-citrate

50.44 g L-histidine

8.20 g Citric acid monohydrate

made up to 1 1 with de-ionised water

4.2.1.2 Running buffer: 0. 072 ML-histidine-citrate pH 6.5

(Stock solution diluted 1 in 5)

400 ml stock solution (4.2.1.1) made up to 2 1 with de-ionised water

4.2.1.3 Gel buffer: 0.024 M L-histidine-citrate

(Stock solution diluted 1 in 15)

80 ml stock solution (4.2.1.1) made up to 1200 ml with de-ionised water

4.2.2 Buffers for SGE pH 5.0

4.2.2.1 Running buffer: 0.074 M L-histidine-citrate pH 5.0

15.5g L-histidine

10.0g Citric acid monohydrate

made up to 2 liters with de-ionised water

4.2.2.2 Gel buffer: 0.006 M L-histidine-citrate

(Running buffer diluted 1 in 12)

100 ml running buffer (4.2.2.1) made up to 1200 ml with de-ionised water

4.2.2.3 Bromophenol blue solution

50 mg bromophenol blue dissolved in 100 ml de-ionised water

4.3 Staining solutions

4.3.1 Stock solutions

4.3.1.1 1 M Tris-HCL pH 8.0

121.1g Tris, made up to 1 liter with de-ionised water and adjusted to pH 8.0 with 50% HCl

4.3.1.2 1 M Tris-HCl pH 9.1

121.1 g Tris, made up to 1 liter with de-ionised water and adjusted to pH 9.1 with 50% HCl

4.3.1.3 1 M Sodium acetate pH 5.0

136.08 g Sodium acetate trihydrate, made up to 1 liter with de-ionised water adjusted to pH 5.0 with acetic acid glacial

4.3.1.4 MTT solution

1.0 g MTT made up to 100 ml with de-ionised water

4.3.1.5 NBT solution

1.0 g NBT made up to 100 ml with de-ionised water

4.3.1.6 PMS solution

200 mg PMS, made up to 100 ml with de-ionised water

4.3.1.7 MgCl2 solution

21.35 g Magnesium chloride hexahydrate

made up to 100 ml with de-ionised water

4.3.1.8 Malic acid solution

5 g LL-Malic acid, made up to 100 ml with de-ionised water and adjusted to pH 8.0 with 1 M NaOH

4.3.2 Staining solutions (volume:  200 ml)

4.3.2.1 MDH + ADH staining solution

20 ml Tris-HCl pH 9.1 (4.3.1.2.)

+ 180 ml de-ionised water

+ 8 ml Malic acid solution (4.3.1.8.)

+ 10 ml Ethanol

+ 80 mg NAD

+ 4 ml NBT solution (4.3.1.5.)

+ 3 ml PMS solution (4.3.1.6.)

4.3.2.2 IDH staining solution

20 ml Tris-HCl pH 8.0 (4.3.1.5.)

+ 180 ml de-ionised water

+ 500 mg DL-Isocitric acid Na3 salt

+ 10 ml MgCl2 solution (4.3.1.7.)

+ 6 mg NADP

+ 4 ml MTT solution (4.3.1.4.)

+ 3 ml PMS solution (4.3.1.6.)

4.3.2.3 PGI + PGD staining solution

20 ml Tris-HC1 pH 8.0 (4.3.1.1.)

+ 180 ml de-ionised water

+ 200 mg Fructose 6-phosphate Na2 salt

+ 80 mg 6-Phosphogluconic acid Na3 salt trihydrate

+ 2 ml MgCl2 solution (4.3.1.7.)

+ 20 mg NADP

+ 2 ml MTT solution (4.3.1.4.)

+ 3 ml PMS solution (4.3.1.6.)

+ 50 units Glucose 6-phosphate dehydrogenase

4.3.2.4 PGM staining solution

20 ml Tris-HC1 pH 8. 0 (4.3.1.1.)

+ 180 ml de-ionised water

+ 1 g Glucose 1-phosphate

+ 200 mg EDTA Na2 salt

+ 4 ml MgCl2 solution (4.3.1.7.)

+ 20 mg NADP

+ 3 ml MTT solution (4.3.1.4.)

+ 2 ml PMS solution (4.3.1.6.)

+ 100 units Glucose 6-phosphate dehydrogenase

4.3.2.5 ACP staining solution

4 ml Sodium acetate p.H 5.0 (4.3.1.3.)

+ 196 ml de-ionised water

+ 200 mg Fast Garnet GBC salt

+ 492 mg 1-Naphthylphosphate Na3 salt dihydrate

+ 2 ml MgCl2 solution (4.3.1.7.)

4.3.2.6 DIA staining solution

20 ml Tris-HC1 pH 9.1 (4.3.1.2.)

+ 180 ml de-ionised water

+ 2 g PVP-40

+ 20 mg NADH

+ 16 ml MTT solution (4.3.1.4.)

+ 16 mg 2,6-Dichlorophenol-indophenol Na salt

5. Procedure

5.1 Enzyme extraction

Maize seedlings are grown on moistened germination paper or in a box with sand or vermiculite, at 25°C, in darkness. After five days, individual coleoptiles are cut at 15 mm from the tip and homogenized at 4°C, with a pestle in micro-tubes containing 0.060 ml extraction solution (3.1). The tubes are then centrifuged at 4°C to obtain a clear supernatant. The extracts can be stored at - 30°C.

5.2 Preparation of the gel

To make two 12.5 % starch gels (18 x 18 x 1 cm) the following is required: 128 g starch are mixed in 1020 ml gel buffer (4.2.1.3. or 4.2.2.2.) in a 1000 ml Buchner flask at 80°C. The mixture is degassed for 40 seconds. The gels are poured into gel moulds as described in the user's manual of the equipment used. The formation of air bubbles should be avoided. The gels are allowed to cool at room temperature, for at least two hours, and wrapped with polyethylene film for overnight storage. Before electrophoresis, the gels are cooled at 4°C for at least one hour.

5.3 Electrophoresis

5.3.1 The tanks are filled with the appropriate volume of running buffer (4.2.1.2. or 4.2.2.1.) pre-cooled to 4°C. A slit is cut in the gel at 1 cm from the cathode. The enzyme extracts from 5.1 (30 extracts for on 18 x 18 x 1 cm gel) are absorbed onto 15 x 2 x 1 mm wicks at from Whatman N° 3 chromatography paper. The wicks are placed into the slit. At 1 cm of each adge of the gels, a wick soaked with bromophenol blue solution (4.2.2.3.) is inserted. The electrophoresis is carried out at 4°C. A constant voltage of 200 V (maximum current of 150 mA for two 18 x 18 x 1 cm gels is applied for 20 minutes). The wicks are then removed and the electrophoresis is continued at a constant voltage of 280 V (maximum current of 180 mA for two 18 x 18 x 1 cm gels), until the bromophenol blue marker has migrated 14 cm (4 hours).

5.4 Enzyme staining

After electrophoresis the gel is cut horizontally in 1 mm thick slices. The upper slice is discarded. Individual gel slices are stained by incubation in the following solutions at 37°C in darkness.

for MDH and ADH: solution 4.3.2.1., for IDH: solution 4.3.2.2.

for PGI and PGD: solution 4.3.2.3., for PGM: solution 4.3.2.4.

for ACP: solution 4.3.2.5., for DIA: solution 4.3.2.6

The ACPs migrate in the first 4 cm of the gel; the PGMs go further; therefore, it is possible to stain these two enzymes on the same gel after having cut it transversally.

The staining times range between 30 and 120 minutes. After staining the gel slices are rinsed in distilled water before being stored. The following procedure for long time storing can be successfully used: e.g. drying the gels between two cellophane sheets or storing in sealed polythene bags.

6. Recognition of the alleles encoding isozymes

6.1 Recognition of the alleles encoding MDH

6.1.1 Genetic interpretation of the zymogrammes



* Alleles 0.5 and 1 from Mdh1 are difficult to discriminate from each other. Therefore, they are scored as identical (note 1). The same is true for alleles 3 and 3.5 from Mdh2 which are scored together (note 1)
* There are interactions between the products of the genes (polypeptide subunits) on the one hand, encoded by Mdh1, Mdh2, Mdh3, and on the other hand, encoded by Mdh4 and Mdh5.



6.1.2 Schematization of the zymogrammes

For the recognition of the alleles at the loci Mdhl, Mdh2 and Mdh4 the SGE at pH 6.5 should be used. For the recognition of the alleles at the loci Mdh3 and Mdh5, a second electrophoresis system should be used : SGE at pH 5.0.

**Zymograms of MDH from maize coleoptile in pH 5.0 buffer system:**



Some bands which are very faint are drawn in dotted lines. Some bands overlap and cannot be drawn in distinct bands.

**Zymograms of MDH from maize coleoptile in pH 6.5 buffer system:**



6.2 Recognition of the alleles encoding IDH

6.2.1 Genetic interpretation of the zymogrammes



There are interactions between the products of the genes (polypeptide subunits) encoded by Idh1 and Idh2.



6.2.2 Schematization of the zymogrammes



Some bands which are very faint are drawn in dotted lines. Some bands overlap and cannot be drawn as distinct bands.

6.3 Recognition of the alleles encoding PGD

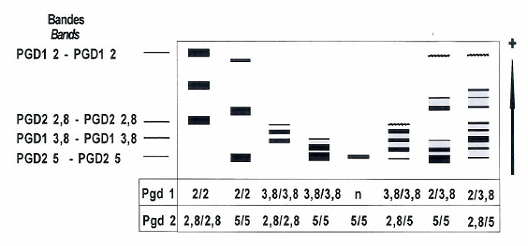
6.3.1 Genetic interpretation of the zymogrammes



There are interactions between the products of the genes (polypeptide subunits) encoded by Pgd1 and Pgd2.



6.3.2 Schematization of the zymogrammes



Some bands which are very faint are drawn in dotted lines. Some bands overlap and cannot be drawn in distinct bands.

6.4 Recognition of the alleles encoding PGM

6.4.1 Genetic interpretation of the zymogrammes





* + 1. Schematization of the zymogrammes



6.4.3 Distinctness table for the different states of expression at the loci Pgm1 + Pgm2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| PGM1 |  |  | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 | 9/9 | 16/16 | 16/16 | 16/16 | 16/16 | 16/16 | 5/5 |
|  | PGM2 |  | 1/1 | 1/3 | 3/3 | 3/4 | 4/4 | 1/4 | 8/8 | 3/8 | 4/8 | 1/8 | 1/1 | 1/3 | 3/3 | 4/4 | 8/8 | 3/3 |
|  |  | **Note** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
| 9/9 | 1/1 | **1** | - | - | + | + | + | - | + | + | + | + | + | + | + | + | + | + |
| 9/9 | 1/3 | **2** | - | - | - | + | + | - | + | + | + | + | + | + | + | + | + | + |
| 9/9 | 3/3 | **3** | + | - | - | - | + | + | + | + | + | + | + | + | + | + | + | + |
| 9/9 | 3/4 | **4** | + | + | - | - | - | + | + | + | + | + | + | + | + | + | + | + |
| 9/9 | 4/4 | **5** | + | + | + | - | - | - | + | + | + | + | + | + | + | + | + | + |
| 9/9 | 1/4 | **6** | - | - | + | + | - | - | + | + | + | + | + | + | + | + | + | + |
| 9/9 | 8/8 | **7** | + | + | + | + | + | + | - | - | - | + | + | + | + | + | + | + |
| 9/9 | 3/8 | **8** | + | + | + | + | + | + | - | - | - | + | + | + | + | + | + | + |
| 9/9 | 4/8 | **9** | + | + | + | + | + | + | - | - | - | + | + | + | + | + | + | + |
| 9/9 | 1/8 | **10** | + | + | + | + | + | + | + | + | + | - | + | + | + | + | + | + |
| 16/16 | 1/1 | **11** | + | + | + | + | + | + | + | + | + | + | - | - | + | + | + | + |
| 16/16 | 1/3 | **12** | + | + | + | + | + | + | + | + | + | + | - | - | - | + | + | + |
| 16/16 | 3/3 | **13** | + | + | + | + | + | + | + | + | + | + | + | - | - | + | + | + |
| 16/16 | 4/4 | **14** | + | + | + | + | + | + | + | + | + | + | + | + | + | - | + | + |
| 16/16 | 8/8 | **15** | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - | + |
| 5/5 | 3/3 | **16** | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - |

Combinations indicated with “+” can be clearly separated. In general, combinations indicated with “-” cannot be separated.

The notes within grey zones should not be used without knowledge of the parent formula.

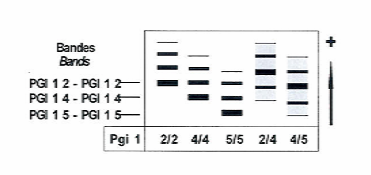
6.5 Recognition of the alleles encoding PGI

6.5.1 Genetic interpretation of the zymogrammes





6.5.2 Schematization of the zymogrammes



6.6 Recognition of the alleles encoding ACP

6.6.1 Genetic interpretation of the zymogrammes





6.6.2 Schematization of the zymogrammes



Some bands overlap and cannot be drawn as distinct bands.

6.6.3 Distinctness table for the different states of expression at the locus Acp1

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ACP1 |  | 2/2 | 2/3 | 3/3 | 4/6 | 4/4 | 6/6 | 2/4 | 2/6 | 3/4 | 3/6 |
|  | **Note** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| 2/2 | **1** | **-** | **-** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |
| 2/3 | **2** | **-** | **-** | **-** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |
| 3/3 | **3** | **+** | **-** | **-** | **+** | **+** | **+** | **+** | **+** | **+** | **+** |
| 4/6 | **4** | **+** | **+** | **+** | **-** | **-** | **-** | **+** | **+** | **+** | **+** |
| 4/4 | **5** | **+** | **+** | **+** | **-** | **-** | **+** | **+** | **+** | **+** | **+** |
| 6/6 | **6** | **+** | **+** | **+** | **-** | **+** | **-** | **+** | **+** | **+** | **+** |
| 2/4 | **7** | **+** | **+** | **+** | **+** | **+** | **+** | **-** | **+** | **+** | **+** |
| 2/6 | **8** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **-** | **+** | **+** |
| 3/4 | **9** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **-** | **+** |
| 3/6 | **10** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **+** | **-** |

Combinations indicated with “+” can be clearly separated. In general, combinations indicated with “-” cannot be separated.

The notes within grey zones should not be used without knowledge of the parent formula.

6.7 Recognition of the alleles encoding DIA

6.7.1 Genetic interpretation of the zymogrammes





6.7.2 Schematization of the zymogrammes

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Bands** | |  |  |  |  |  |  |  |  |  |
| Dia 1 8 |  |  |  |  |  |  |  |  |  | + |
| Dia 1 12 |  |  |  |  |  |  |  |  |  |  |
| Dia 2 4 |  |  |  |  |  |  |  |  |  |  |
| Dia 2 6 |  |  |  |  |  |  |  |  |  |  |
|  | Dia 1 | 8/8 | 12/12 | 8/12 | 8/8 | 12/12 | 8/12 | 8/8 | 12/12 | 8/12 |
|  | Dia 2 | 4/4 | 4/4 | 4/4 | 6/6 | 6/6 | 6/6 | 4/6 | 4/6 | 4/6 |

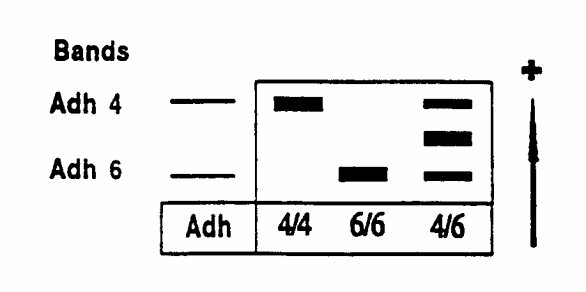
6.8 Recognition of the alleles encoding ADH

6.8.1 Genetic interpretation of the zymogrammes





6.8.2 Schematization of the zymogrammes



Description of the example inbred lines



[End of Annex and of document]

1. \* 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.] [↑](#footnote-ref-1)
2. held by electronic means, from May 5 to 8, 2025. [↑](#footnote-ref-2)
3. # Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire. [↑](#footnote-ref-3)
4. ## Authorities may choose to request this information [↑](#footnote-ref-4)
5. # Authorities may allow certain of this information to be provided in a confidential section of the Technical Questionnaire. [↑](#footnote-ref-5)