



Descriptors for wild and cultivated

Rice

(*Oryza* spp.)



IRRI



List of Descriptors

Allium (E,S)	2000	Peach * (E)	1985
Almond (revised) * (E)	1985	Pear * (E)	1983
Apple * (E)	1982	Pearl millet (E,F)	1993
Apricot * (E)	1984	Pepino (E)	2004
Avocado (E,S)	1995	<i>Phaseolus acutifolius</i> (E)	1985
Bambara groundnut (E,F)	2000	<i>Phaseolus coccineus</i> * (E)	1983
Banana (E,S,F)	1996	<i>Phaseolus lunatus</i> (P)	2001
Barley (E)	1994	<i>Phaseolus vulgaris</i> * (E,P)	1982
Beta (E)	1991	Pigeonpea (E)	1993
Black pepper (E,S)	1995	Pineapple (E)	1991
<i>Brassica</i> and <i>Raphanus</i> (E)	1990	<i>Pistacia</i> (excluding <i>Pistacia vera</i>) (E)	1998
<i>Brassica campestris</i> L. (E)	1987	Pistachio (E,F,A,R)	1997
Buckwheat (E)	1994	Plum * (E)	1985
Capsicum * (E,S)	1995	Potato variety * (E)	1985
Cardamom (E)	1994	Quinoa * (S)	1981
Carrot (E,S,F)	1999	Rambutan (E)	2003
Cashew * (E)	1986	Rice * (E)	1980
<i>Chenopodium pallidicaule</i> (S)	2005	Rocket (E,I)	1999
Cherry * (E)	1985	Rye and <i>Triticale</i> * (E)	1985
Chickpea (E)	1993	Safflower * (E)	1983
Citrus (E,F,S)	1999	Sesame * (E)	2004
Coconut (E)	1992	<i>Setaria italica</i> and <i>S. pumila</i> (E)	1985
Coffee (E,S,F)	1996	Shea tree (E)	2006
Cotton * (Revised) (E)	1985	Sorghum (E,F)	1993
Cowpea * (E)	1983	Soyabean * (E,C)	1984
Cultivated potato * (E)	1977	Strawberry (E)	1986
Date palm (F)	2005	Sunflower * (E)	1985
Echinochloa millet * (E)	1983	Sweet potato (E,S,F)	1991
Eggplant (E,F)	1990	Taro (E,F,S)	1999
Faba bean * (E)	1985	Tea (E,S,F)	1997
Fig (E)	2003	Tomato (E, S, F)	1996
Finger millet * (E)	1985	Tropical fruit * (E)	1980
Forage grass * (E)	1985	Ulluco (S)	2003
Forage legumes * (E)	1984	<i>Vigna aconitifolia</i> and <i>V. trilobata</i> (E)	1985
Grapevine (E,S,F)	1997	<i>Vigna mungo</i> and <i>V. radiata</i> (Revised) * (E)	1985
Groundnut (E,S,F)	1992	Walnut (E)	1994
Jackfruit (E)	2000	Wheat (Revised) * (E)	1985
Kodo millet * (E)	1983	Wheat and <i>Aegilops</i> * (E)	1978
<i>Lathyrus</i> spp. (E)	2000	White clover (E)	1992
Lentil * (E)	1985	Winged bean * (E)	1979
Lima bean * (E)	1982	Xanthosoma * (E)	1989
Litchi	2002	Yam (E,S,F)	1997
Lupin * (E,S)	1981		
Maize (E,S,F, P)	1991		
Mango (E)	2006		
Mangosteen (E)	2003		
Medicago (Annual) * (E,F)	1991		
Melon (E)	2003		
Mung bean * (E)	1980		
Oat * (E)	1985		
Oca * (S)	2001		
Oil palm (E)	1989		
<i>Panicum miliaceum</i> and <i>P. sumatrense</i> (E)	1985		
Papaya (E)	1988		

Bioversity's publications are available free of charge to the libraries of genebanks, university departments, research institutions, etc., in the developing world. E, F, S, C, P, I, R and A indicate English, French, Spanish, Chinese, Portuguese, Italian, Russian and Arabic, respectively. Titles marked with an asterisk are out of print, but are available as Adobe Acrobat portable document format (PDF) on request (send email to Bioversity-publications@cgiar.org). Organizations in the developed world and individuals requiring personal copies can order copies of Bioversity's publications from EarthPrint.com (www.earthprint.com).

Descriptors for wild and cultivated

Rice

(*Oryza* spp.)

Bioversity International is an independent international scientific organization that seeks to improve the well-being of present and future generations of people by enhancing conservation and the deployment of agricultural biodiversity on farms and in forests. It is one of 15 centres supported by the Consultative Group on International Agricultural Research (CGIAR), an association of public and private members who support efforts to mobilize cutting-edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment. Bioversity has its headquarters in Maccarese, near Rome, Italy, with offices in more than 20 other countries worldwide. The Institute operates through four programmes: Diversity for Livelihoods, Understanding and Managing Biodiversity, Global Partnerships, and Commodities for Livelihoods.

The international status of Bioversity is conferred under an Establishment Agreement which, by January 2006, had been signed by the Governments of Algeria, Australia, Belgium, Benin, Bolivia, Brazil, Burkina Faso, Cameroon, Chile, China, Congo, Costa Rica, Côte d'Ivoire, Cyprus, Czech Republic, Denmark, Ecuador, Egypt, Greece, Guinea, Hungary, India, Indonesia, Iran, Israel, Italy, Jordan, Kenya, Malaysia, Mali, Mauritania, Morocco, Norway, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russia, Senegal, Slovakia, Sudan, Switzerland, Syria, Tunisia, Turkey, Uganda and Ukraine.

Financial support for Bioversity's research is provided by more than 150 donors, including governments, private foundations and international organizations. For details of donors and research activities please see Bioversity's Annual Reports, which are available in printed form on request from bioversity-publications@cgiar.org or from Bioversity's Web site (www.bioversityinternational.org).

The geographical designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of Bioversity or the CGIAR concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries. Similarly, the views expressed are those of the authors and do not necessarily reflect the views of these organizations.

Mention of a proprietary name does not constitute endorsement of the product and is given only for information.

The International Rice Research Institute (IRRI) is an independent international scientific organization that seeks to reduce poverty and hunger, improve the health of rice farmers and consumers, and ensure environmental sustainability through collaborative research, partnerships, and the strengthening of national agricultural research and extension systems. It is one of the 15 Future Harvest Centres supported by the CGIAR, and has its headquarters in Los Baños, near Manila, Philippines. It has five primary goals: to reduce poverty through improved and diversified rice-based systems; to ensure that rice production is sustainable and stable, has minimal negative environmental impact, and can cope with climate change; to improve the nutrition and health of poor rice consumers and rice farmers; to provide equitable access to information and knowledge on rice and help develop the next generation of rice scientists; and to provide rice scientists and producers with the genetic information and material they need to develop improved technologies and enhance rice production.

WARDA's mission is to contribute to poverty alleviation and food security in Africa, through research, development, and partnership activities aimed at increasing the productivity and profitability of the rice sector in ways that ensure the sustainability of the farming environment.

Citation

Bioversity International, IRRI and WARDA. 2007. Descriptors for wild and cultivated rice (*Oryza* spp.). Bioversity International, Rome, Italy; International Rice Research Institute, Los Baños, Philippines; WARDA, Africa Rice Center, Cotonou, Benin

ISBN-13: 978-92-9043-716-1

ISBN-10: 92-9043-716-2

Bioversity encourages the use of material from this publication for educational or other non-commercial purposes without prior permission from the copyright holder. Acknowledgement of Bioversity's material is required. This publication is available to download in portable document format from www.cgiar.org/bioversity/.

Bioversity International
Via dei Tre Denari, 472/a
00057 Maccarese
Rome, Italy

IRRI
DAPO Box 7777
Metro Manila
Philippines

WARDA
Africa Rice Center
01 B.P. 2031, Cotonou
Benin

© Bioversity International, 2007

CONTENTS

PREFACE	1
DEFINITIONS AND USE OF THE DESCRIPTORS	3
PASSPORT	7
1. Accession descriptors	7
2. Collecting descriptors	9
MANAGEMENT	15
3. Seed management descriptors	15
4. Multiplication/regeneration descriptors	16
ENVIRONMENT AND SITE	17
5. Characterization and/or evaluation site descriptors	17
6. Collecting and/or characterization/evaluation site environment descriptors	18
CHARACTERIZATION	21
7. Plant descriptors	21
EVALUATION	43
8. Plant descriptors	43
9. Abiotic stress sensitivity	45
10. Biotic stress sensitivity	46
11. Biochemical markers	47
12. Molecular markers	48
13. Cytological characters	48
14. Identified genes	49
BIBLIOGRAPHY	50
CONTRIBUTORS	52
ACKNOWLEDGEMENTS	54
ANNEX I. List of highly discriminating descriptors for rice	55
ANNEX II. Comparison table for colour descriptors	56
ANNEX III. Cross-references to other documentation systems and their recording stages	57

PREFACE

'**Descriptors for wild and cultivated rice (*Oryza* spp.)**' is a revision of the original IBPGR and IRRI publication 'Descriptors for rice (*Oryza sativa* L.)' (1980), expanded to include descriptors for wild rice species of the genus *Oryza*, and harmonized as far as possible with descriptors developed by the International Union for the Protection of New Varieties of Plants (UPOV 2004; www.upov.org) for new cultivars of cultivated rice. The 1980 list has been widely used and is considered to be the most valid descriptor system for rice. This revision has been developed in collaboration with Ruaraidh Sackville Hamilton, Renato Reaño, Socorro Almazan, Elizabeth Naredo, Maria Celeste Banaticla, Edwin Javier and Melissa Fitzgerald of IRRI, and subsequently sent to a number of experts for their comments. A full list of the names and addresses of those involved is given in 'Contributors'.

Bioversity International (formerly known as IPGRI) encourages the collecting of data for all five types of descriptors (see Definitions and Use of Descriptors), whereby data from the first four categories—*Passport, Management, Environment and Site*, and *Characterization*—should be available for any accession. The number of descriptors selected in each of the categories will depend on the crop and their importance to the crop's description. Descriptors listed under *Evaluation* allow for a more extensive description of the accession, but generally require replicated trials over a period of time.

Although the suggested coding should not be regarded as the definitive scheme, this format represents an important tool for a standardized characterization system and it is promoted by Bioversity throughout the world.

This descriptor list provides an international format and thereby produces a universally understood 'language' for plant genetic resources data. The adoption of this scheme for data encoding, or at least the production of a transformation method to convert other schemes into the Bioversity format, will produce a rapid, reliable, and efficient means for information storage, retrieval and communication, and will assist with the use of germplasm. It is recommended, therefore, that information should be produced by closely following the descriptor list with regard to ordering and numbering descriptors, using the descriptors specified and using the descriptor states recommended.

This descriptor list is intended to be comprehensive for the descriptors that it contains. This approach assists with the standardization of descriptor definitions. Bioversity does not, however, assume that curators will characterize accessions of their collection using all descriptors given. Descriptors should be used when they are useful to curators for the management and maintenance of the collection and/or to the users of plant genetic resources. However, highly discriminating descriptors are highlighted in the text to facilitate the selection of descriptors and are listed in Annex I.

Multicrop passport descriptors were developed jointly by Bioversity and FAO to provide consistent coding schemes for common passport descriptors across crops. They are marked in the text as [MCPD]. Owing to the generic nature of the multicrop passport descriptors, not all descriptor states for a particular descriptor will be relevant to a specific crop.

A comparison table of standard colour charts is provided in Annex II for conversion of colour descriptors and Annex III has a table containing cross-references to other documentation systems and their recording stages.

Any suggestions for improvement on the 'Descriptors for wild and cultivated rice' will be highly appreciated by Bioversity, IRRI and WARDA.

DEFINITIONS AND USE OF THE DESCRIPTORS

Bioversity uses the following definitions in genetic resources documentation:

Passport descriptors: These provide the basic information used for the general management of the accession (including registration at the genebank and other identification information) and describe parameters that should be observed when the accession is originally collected.

Management descriptors: These provide the basis for the management of accessions in the genebank and assist with their multiplication and regeneration.

Environment and site descriptors: These describe the environmental and site-specific parameters that are important when characterization and evaluation trials are held. They can be important for the interpretation of the results of those trials. Site descriptors for germplasm collecting are also included here.

Characterization descriptors: These enable an easy and quick discrimination between phenotypes. They are generally highly heritable, can be easily seen by the eye and are equally expressed in all environments. In addition, these may include a limited number of additional traits thought desirable by a consensus of users of the particular crop.

Evaluation descriptors: The expression of many of the descriptors in this category will depend on the environment; consequently, special experimental designs and techniques are needed to assess them. Their assessment may also require complex biochemical or molecular characterization methods. These types of descriptors include characters such as yield, agronomic performance, stress susceptibilities and biochemical and cytological traits. They are generally the most interesting traits in crop improvement.

Characterization will normally be the responsibility of genebank curators, while evaluation will typically be carried out elsewhere (possibly by a multidisciplinary team of scientists). The evaluation data should be fed back to the genebank, which will maintain a data file.

Highly discriminating descriptors are **highlighted** in the text.

The following internationally accepted norms for the scoring, coding and recording of descriptor states should be followed:

- (a) the *Système International d'Unités* (SI) is used;
- (b) the units to be applied are given in square brackets following the descriptor name;
- (c) standard colour charts, e.g. Royal Horticultural Society Colour Chart, Methuen Handbook

of Colour, or Munsell Color Chart for Plant Tissues, are strongly recommended for all colour characters (the precise chart used should be specified in the section where it is used);

(d) the three-letter abbreviations from the *International Standard (ISO) Codes for the representation of names of countries* are used;

(e) quantitative characters, i.e. those that are continuously variable, should preferably be measured quantitatively. Alternatively, in cases where it is difficult to measure quantitatively, it is acceptable to score instead on a 1–9 scale, where

1	Very low	6	Intermediate to high
2	Very low to low	7	High
3	Low	8	High to very high
4	Low to intermediate	9	Very high
5	Intermediate		

The authors of this list have sometimes described only a selection of the states, e.g. 3, 5 and 7, for such descriptors. Where this has occurred, the full range of codes is available for use by extension of the codes given or by interpolation between them, e.g. in Section 10 (Biotic stress sensitivity), 1 = very low sensitivity and 9 = very high sensitivity;

(f) when a descriptor is scored using a 1–9 scale, such as in (e), 0 would be scored when (i) the character is not expressed and (ii) a descriptor is inapplicable. In the following example, 0 will be recorded if an accession does not have a ligule:

Ligule shape

0	Absent
1	Acute to acuminate
2	2-cleft
3	Tip round or truncate

(g) absence/presence of characters is scored as in the following example:

Terminal leaflet

0	Absent
1	Present

(h) stages: this refers to the stage of development when the descriptor is recorded.

(i) blanks are used for information not yet available;

(j) for accessions that are not generally uniform for a descriptor (e.g. mixed collection, genetic segregation), the mean and standard deviation could be reported where the descriptor is continuous. Where the descriptor is discontinuous, several codes in the order of frequency

could be recorded, or other publicized methods could be used, such as Rana *et al.* (1991) or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;

- (k) dates should be expressed numerically in the format YYYYMMDD, where
- | | |
|------|---------------------------------|
| YYYY | 4 digits to represent the year |
| MM | 2 digits to represent the month |
| DD | 2 digits to represent the day |
- (l) leaf descriptors: unless otherwise specified, all descriptors for leaves and their components (ligule, auricle, collar, sheath and blade) are recorded on the penultimate leaf, i.e. the highest leaf below the flag leaf;
- (m) biosafety and wild rice: some species of wild rice are invasive weedy species able to cross-pollinate with cultivated rice. As such, they are subject to strict biosafety regulations in many countries. They should be characterized only in suitable containment facilities, and are therefore normally grown in pots rather than plots. This restriction influences how plants may be characterized (e.g. for assessment of culm strength);
- (n) **Glossary of morphological terms**
 Illustrations of the terms below are available in an online IRRI training course at www.training.irri.org/courseware/online/morphology/Morphology.pdf.

Awn: a fibrous bristle present in some cultivars, formed as an extension of the midrib of the lemma.

Caryopsis: the fruit of grasses, consisting of a single seed with the seed coat fused to a thin dry pericarp. In rice, the caryopsis is commonly called brown rice—the structure that remains after dehulling the grain and before milling.

Floret: in grasses, the reproductive unit of a spikelet, consisting of a lemma and a palea around a small single-ovule flower.

Glume: in grasses, any of several types of bract in a spikelet, including the lemma and palea.

Grain: a mature grain of rice consists of a caryopsis enclosed within a lemma and palea.

Lemma: the larger (lower) of two bracts that contain the flower. The lemma and palea provide a protective covering for the flower as well as for the seed after ripening, and together are known as the hull of the seed.

Palea: the smaller (upper) of two bracts that contain the flower and later the seed.

Pericarp: the fruit wall. In grasses, the pericarp forms the outer surface of the caryopsis and is fused with the seed coat.

Spikelet: the flowering unit of grasses, comprising one or more florets with two bracts (glumes) at the base of the spikelet. In rice, the spikelet is reduced from a basic three-floret structure, in which only a single apical floret remains functional. This is bounded by two 'sterile lemmas', the only remaining vestiges of two lower florets. The two glumes at the base are highly reduced, rudimentary bracts.

PASSPORT

All descriptors listed under Passport, belonging to the multicrop passport descriptors category, are indicated in the text as [MCPD].

1. Accession descriptors

- 1.1 Institute code** [MCPD]
Code of the institute where the accession is maintained. The codes consist of the three-letter ISO 3166 code of the country where the institute is located, plus a number. The current set of institute codes is available from the FAO Web site (www.fao.org).
- 1.2 Accession number** (1) [MCPD]
This number serves as a unique identifier for accessions within a genebank collection, and is assigned when a sample is entered into the genebank collection. Once assigned, this number should never be reassigned to another accession in the collection. Even if an accession is lost, its assigned number should never be reused. Letters should be used before the number to identify the genebank or national system (e.g. CGN indicates an accession from the genebank at Wageningen, The Netherlands; PI indicates an accession within the U.S. system; a prefix of IRGC indicates an accession from the genebank at IRRI).
- 1.3 Donor name**
Name of institution or individual responsible for donating the germplasm.
- 1.4 Donor institute code** [MCPD]
Code for the donor institute. (See instructions under **Institute code**, 1.1.)
- 1.5 Donor accession number** (2) [MCPD]
Number assigned to an accession by the donor. (See instructions under **Accession number**, 1.1.)
- 1.6 Other identification number(s) associated with the accession** (3) [MCPD]
Any other identification (numbers) known to exist in other collections for this accession. Use the following system: INSTCODE:ACCENUMB; INSTCODE:ACCENUMB;... INSTCODE and ACCENUMB follow the standard described above and are separated by a colon. Pairs of INSTCODE and ACCENUMB are separated by a semicolon without space. When the institute is not known, the number should be preceded by a colon.

1.7 Scientific name (1.2)**1.7.1 Genus** [MCPD]

Genus name for taxon. Initial uppercase letter required.

1.7.2 Species [MCPD]

Specific epithet portion of the scientific name in lowercase letters. The abbreviation 'sp.' is used if the species is unknown.

1.7.2.1 Species authority [MCPD]

Provide the authority for the species name.

1.7.3 Subtaxa [MCPD]

Subtaxa can be used to store any additional taxonomic identifier.

1.7.3.1 Rank name

The rank of the subtaxon name. The following abbreviations are allowed: 'subsp.' (for subspecies); 'convar.' (for convariety); 'var.' (for botanical variety); 'f.' (for form).

1.7.3.2 Subtaxon name

The infraspecific epithet of the scientific name (i.e. the epithet following the indication of the infraspecific rank in the name string).

1.7.3.3 Subtaxon authority

Provide the subtaxon authority at the most detailed taxonomic level.

1.7.4 Cultivar group (morphology)

Asian cultivated rice (*Oryza sativa*) only. Stage: flowering to maturity.

O. sativa is classified into two major cultivar groups, indica and japonica, based traditionally on morphological and grain characteristics. Other groups have also been recognized but since the variation in morphological features among cultivars is continuous, it is often difficult to make an accurate classification. Isozyme data and molecular data are generating new insights but are not entirely consistent with the morphological classifications (Glaszmann 1987); for example, it is quite common for accessions to be classified as indica by morphology but japonica by isozymes. Both systems are therefore provided here, although this may need to be revised as new information is obtained. The traditional morphological classification recognizes four major groups:

- 1 indica
- 2 temperate japonica (japonica, sinica)
- 3 tropical japonica (javanica)
- 4 intermediates (hybrids)

1.7.5 Cultivar group (isozymes)

Asian cultivated rice (*Oryza sativa*) only. From Glaszmann (1987):

- 1 Group I (indica)
- 2 Group II (aus group)
- 3 Group III (deepwater rice a)
- 4 Group IV (deepwater rice b)
- 5 Group V (basmati group)
- 6 Group VI (japonica, temperate and tropical)
- 7 Intermediates

1.8 Ancestral data (1.6) [MCPD]

Information about pedigree or other description of ancestral information (e.g. parent cultivar in case of mutant or selection). For example, a pedigree 'Hanna/7*Atlas//Turk/8*Atlas' or a description 'mutation found in Hanna', 'selection from Irene' or 'cross involving, among others, Hanna and Irene'.

1.9 Accession**1.9.1 Accession name** (2) [MCPD]

Either a registered or other formal designation given to the accession. First letter uppercase. Multiple names separated with semicolon without space. For example: Rheinische Vorgebirgstrauben;Emma;Avlon.

1.9.2 Synonyms

Include here any previous identification other than the current name. Collecting number or newly assigned station names are frequently used as identifiers.

1.9.3 Common crop name [MCPD]

Name of the crop in colloquial language.

1.10 Acquisition date [YYYYMMDD] [MCPD]

Date on which the accession entered the collection where YYYY is the year, MM is the month and DD is the day. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required.

1.11 Notes

This field is used to add notes or to elaborate on descriptors with value '99' or '999' (= Other).

2. Collecting descriptors

- 2.1 Collecting institute code** [MCPD]
Code of the institute collecting the sample. If the holding institute has collected the material, the collecting institute code should be the same as the holding institute code (see instructions under Institute Code, 1.1).
- 2.2 Collecting number** [MCPD]
Original number assigned by the collector(s) of the sample, normally composed of the name or initials of the collector(s) followed by a number. This item is essential for identifying duplicates held in different collections. It should be unique and always accompany subsamples wherever they are sent.
- 2.3 Collecting date of original sample** [YYYYMMDD] [MCPD]
Collecting date of the sample, where YYYY is the year, MM is the month and DD is the day. Missing data (MM or DD) should be indicated with hyphens. Leading zeros are required.
- 2.4 Country of origin** (5) [MCPD]
Code of the country in which the sample was originally collected. Use the three-letter abbreviation from the *International Standard (ISO) Codes for the representation of names of countries*.
- 2.5 Province/State**
Name of the primary administrative subdivision of the country in which the sample was collected.
- 2.6 Department/County**
Name of the secondary administrative subdivision (within a province/state) of the country in which the sample was collected.
- 2.7 Location of collecting site** [MCPD]
Location information below the country level that describes where the accession was collected. This might include the distance in kilometres and direction from the nearest town, village or map grid reference point (e.g. 7 km south of Curitiba in the state of Paraná).

- 2.8 Latitude of collecting site [DDMMSSH]¹ [MCPD]**
 Degrees, minutes and seconds followed by hemisphere, N (North) or S (South) (e.g. 103015S). Missing data (minutes and/or seconds) should be indicated with hyphens. Leading zeros are required (e.g. 10----S).
- 2.9 Longitude of collecting site [DDMMSSH] [MCPD]**
 Degrees, minutes and seconds followed by E (East) or W (West) (e.g. 0762552W). Missing data (minutes and/or seconds) should be indicated with hyphens. Leading zeros are required (e.g. 076----E).
- 2.10 Elevation of collecting site [m asl] [MCPD]**
- 2.11 Collecting source [MCPD]**
- 10 Wild habitat
 - 11 Forest/woodland
 - 12 Shrubland
 - 13 Grassland
 - 14 Desert/tundra
 - 20 Farm
 - 21 Field
 - 22 Orchard
 - 23 Garden
 - 24 Fallow
 - 25 Pasture
 - 26 Store
 - 30 Market
 - 31 Town
 - 32 Village
 - 33 Urban area (around city)
 - 34 Other exchange system
 - 40 Institute/research organization
 - 99 Other (specify in descriptor **2.19, Collector's notes**)
- 2.12 Breeding institute code [MCPD]**
 Institute code of the institute that has bred the material. If the holding institute has bred the material, the breeding institute code should be the same as the holding institute code. It follows the institute code standard.

¹ To convert from longitude and latitude in degrees (°), minutes (′), seconds (″), and a hemisphere (North or South and East or West) to decimal degrees, the following formula should be used:

$$d^{\circ} m' s'' = h * (d + m / 60 + s / 3600)$$

where h = 1 for the Northern and Eastern hemispheres and -1 for the Southern and Western hemispheres, e.g. 30°30'0'' S = -30.5 and 30°15'55'' N = 30.265.

2.13 Type of sample collected

Type of sample collected. If different types of material were collected from the same source, each sample type should be designated with a unique collecting number and a corresponding unique accession number:

- 1 Seed
- 2 Panicles
- 3 Vegetative sample

2.14 Biological status of accession

[MCPD]

- 100 Wild
- 200 Weedy
- 300 Traditional cultivar/landrace
- 400 Breeding/research material
 - 410 Breeder's line
 - 420 Mutant/genetic stock
- 500 Advanced/improved cultivar
- 999 Other (specify in descriptor 2.19, **Collector's notes**)

2.15 Ethnobotanical data

2.15.1 Ethnic group

Name of the ethnic group of the donor of the sample or of the people living in the area of collecting.

2.15.2 Local vernacular name (local script, Unicode text)

Name given by farmer to crop, cultivar, landrace, clone or wild form. Use Unicode text to specify the name using the standard script of the local language. This serves as the definitive version of the name.

2.15.2.1 Language of local vernacular name

Specify local language and/or dialect of the name.

2.15.2.2 Preferred transliterated local vernacular name (Roman script)

The preferred anglicized ASCII equivalent of the name in 2.15.2. (Note: in some of the richer scripts, more than one distinct name in 2.15.2 can be transliterated to the same ASCII text. Therefore, the anglicized form must not be treated as a unique name.)

2.15.2.3 Alternative transliterated local vernacular names (Roman script)

If the name in 2.15.2 can be transliterated in more than one way, provide all commonly used transliterated variants of the form given in 2.15.2.2, separated by semicolons. For example, if 2.15.2 is 'កែវប្រឡាយ', 2.15.2.2 is 'Kai Noi' and 2.15.2.3 would be 'Kay Noi;Kay Noy;Kay Noy;KayNoi;KayNoy;KaiNoi;KayNoy'.

2.15.2.4 Meaning of local vernacular name

Provide a literal translation or an interpretation of the local vernacular name.

2.15.3 Sample origin

- 1 Local (indigenous)
- 2 Exotic (introduced)

2.15.4 Use of samples collected

- 1 Grain
- 2 Stalk
- 3 Forage
- 99 Other (specify in descriptor 2.19, Collector's notes)

2.15.4.1 Special uses

- 1 Religious purpose
- 2 Special ceremonies
- 99 Other (specify in descriptor 2.19, Collector's notes)

2.15.4.2 Special users

- 1 Children
- 2 Older people

2.15.5 Special characteristics

Describe briefly particular characteristics of the rice cultivar (e.g. popularity).

2.15.6 Preferred growing conditions

Describe farmers' perceptions on hardiness of the cultivar in relation to main stresses.

2.15.7 Prevailing stresses

Information on main associated biotic (pests and diseases) and abiotic (drought) stresses.

2.15.8 Cultural practices

2.15.8.1 Sowing date [YYYYMMDD]

2.15.8.2 Harvest date [YYYYMMDD]

2.16 Herbarium specimen

Was a herbarium specimen collected? If so, provide an identification number and indicate in which place (herbarium) the rice specimen was deposited, in descriptor **2.19, Collector's notes**.

- 0 No
- 1 Yes

2.17 Collecting source environment

Use descriptors **6.1.1** to **6.1.12** in section 6.

2.18 Plant population density

Visual assessment of plants per hectare

- 1 Abundant
- 2 Frequent
- 3 Occasional
- 4 Rare

2.19 Collector's notes

Additional information recorded by the collector or any specific information on any state in any of the above descriptors.

MANAGEMENT

3. Seed management descriptors

- 3.1 Accession number** [Passport 1.2]
- 3.2 Population identification** [Passport 2.2]
- 3.3 Storage address**
State building, room, medium- and/or long-term storage.
- 3.4 Storage date** [YYYYMMDD]
- 3.5 Type of germplasm storage** [MCPD]
If germplasm is maintained under different types of storage, multiple choices are allowed, separated by a semicolon (e.g. 20;30). (Refer to FAO/IPGRI Genebank Standards 1994 for details on storage type.)
- 10 Seed collection
 - 11 Short term
 - 12 Medium term
 - 13 Long term
 - 20 Field collection
 - 30 *In vitro* collection (slow growth)
 - 40 Cryopreserved collection
 - 99 Other (elaborate in **3.11, Notes**)
- 3.6 Seed germination rate at storage (initial)** [%]
- 3.7 Date of last seed germination test** [YYYYMMDD]
- 3.8 Seed germination rate at last test** [%]
- 3.9 Accession size** [g]
Approximate amount of seeds of an accession in the genebank.
- 3.10 Location(s) of safety backup(s) of this accession** [Passport 1.4] [MCPD]
Code of the institute where a safety duplicate of the accession is maintained. It follows the institute code standard. See instructions under **1.1, Institute code**.
- 3.11 Notes**
Any additional information can be specified here.

4. Multiplication/regeneration descriptors

Parent

4.1 **Accession number** [Passport 1.2]

4.2 **Population identification** [Passport 2.2]

4.3 **Field plot number**

4.4 **Multiplication/regeneration site location**

4.5 **Seedling status**

(IRRI)

0 NV Non-viable

1 V Viable

4.6 **Seedling vigour** [IS-1]

Assessed between 5th and 10th leaf stage

4.7 **Previous multiplication and/or regeneration**

4.7.1 **Location**

4.7.2 **Plot number**

4.8 **Notes**

Any additional information can be specified here.

ENVIRONMENT AND SITE

5. Characterization and/or evaluation site descriptors

5.1 Country of characterization and/or evaluation
(See instructions in descriptor 2.4, Country of origin).

5.2 Site (research institute)

5.2.1 Latitude
(See format under 2.8)

5.2.2 Longitude
(See format under 2.9)

5.2.3 Elevation [m asl]

5.2.4 Name of farm or institute

5.3 Sowing date [YYYYMMDD]

5.4 Evaluation environment

Environment in which characterization/evaluation was carried out
(IRRI)

- | | | |
|---|---|-----------------------|
| 1 | F | Field |
| 2 | N | Nursery or greenhouse |
| 3 | L | Laboratory |
| 4 | P | Phytotron |

5.5 Sowing site in the field

Give block, strip and/or row plot numbers as applicable.

5.6 Field spacing

5.6.1 Distance between plants in a row [cm]

5.6.2 Distance between rows [cm]

5.7 Environmental characteristics of site

Use descriptors 6.1.1 to 6.1.12 in section 6.

5.8 Notes

Any other site-specific information.

6. Collecting and/or characterization/evaluation site environmental descriptors

6.1 Site environment

6.1.1 Topography

- 1 Swamp
- 2 Floodplain
- 3 Plain level
- 4 Undulating
- 5 Hilly
- 6 Mountainous
- 99 Other (specify in appropriate section's Notes)

6.1.2 Land element and position

Description of the geomorphology of the immediate surroundings of the site (adapted from FAO 1990). (See Fig. 1)

- | | |
|----------------------|--|
| 1 Plain level | 17 Interdunal depression |
| 2 Escarpment | 18 Mangrove |
| 3 Interfluve | 19 Upper slope |
| 4 Valley | 20 Midslope |
| 5 Valley floor | 21 Lower slope |
| 6 Channel | 22 Ridge |
| 7 Levee | 23 Beach |
| 8 Terrace | 24 Beachridge |
| 9 Floodplain | 25 Rounded summit |
| 10 Lagoon | 26 Summit |
| 11 Pan | 27 Coral atoll |
| 12 Caldera | 28 Drainage line (bottom |
| 13 Open depression | position in flat or almost-flat terrain) |
| 14 Closed depression | 29 Coral reef |
| 15 Dune | 99 Other (specify in |
| 16 Longitudinal dune | appropriate section's Notes) |

6.1.3 Slope [°]

Estimated slope of the site

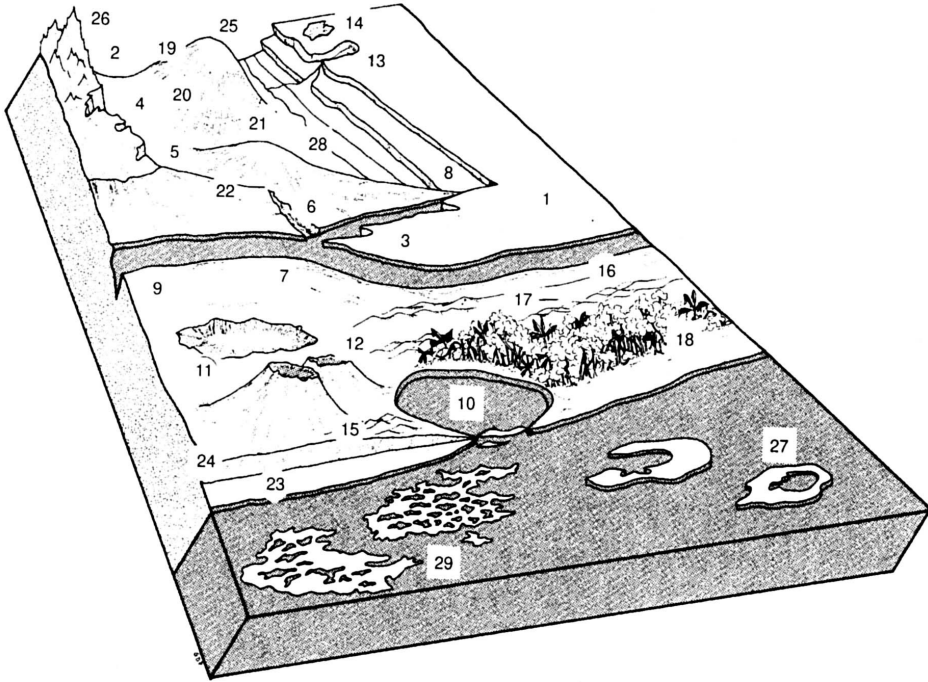


Fig. 1. Land element and position

6.1.4 Slope aspect

The direction that the slope on which the accession was collected faces. Describe the direction with symbols N, S, E, W (e.g. a slope that faces a south-western direction has an aspect of SW)

6.1.5 Ecological zone

- 1 Forest
- 2 Transition zone
- 3 Derived savannah
- 4 Guinea savannah
- 5 Sudan savannah
- 6 Sahel (semi-desert)
- 7 Montane/highland

6.1.6 Soil drainage

- 1 Poor
- 2 Moderate
- 3 Good
- 4 Excessive

6.1.7 Soil salinity

- 1 <160 ppm dissolved salts
- 2 160–240 ppm
- 3 241–480 ppm
- 4 >480 ppm

6.1.8 Soil pH

Actual pH value of the soil around the accession

6.1.8.1 Root depth [cm]

Indicate the root depth at which the soil pH is being measured.

6.1.9 Soil texture classes

- 1 Sand
- 2 Loam
- 3 Clay
- 4 Silt
- 5 Highly organic

6.1.10 Soil taxonomic classification

As detailed a classification as possible should be given. This may be taken from a soil survey map. State class (e.g. Alfisols, Spodosols, Vertisols, etc.).

6.1.11 Climate of the site

Should be assessed as close to the site as possible.

6.1.11.1 Temperature [°C]

Provide either the monthly or the annual mean.

6.1.11.2 Rainfall [mm]

Provide either the monthly or the annual mean.

6.1.11.2.1 Number of recorded years

6.1.12 Notes

Indicate here any additional information.

CHARACTERIZATION

7. Plant descriptors

- **Colour:** To keep colour description simple, both Bioversity and IRRI colour codes for colour descriptors have been listed. The IRRI colour coding system uses one code for one colour regardless of the descriptor. To ensure consistent recording of colour states, the use of standard colour charts is recommended; use the IRRI colour code in conjunction with Annex II to look up the corresponding colour in the Methuen or RHS standard charts.
- **Quantitative characters:** For all quantitative descriptors, it is recommended to use actual measurements. Coded scores for *Oryza sativa* are provided as an alternative where resources are insufficient to take actual measurements.
- **Taxonomic applicability:** Descriptors listed here are applicable for wild and cultivated species, unless otherwise specified.
- A table summarizing descriptor cross-references to other documentation systems (e.g. UPOV) and their recording stage can be found in Annex III.

7.1 Population uniformity

- 1 Homogeneous
- 2 Heterogeneous (specify in descriptor 7.6, Notes)

7.2 Growth cycle traits

Growth cycle traits can be recorded as days from effective seeding date or as actual dates [YYYYMMDD] of events in the growth cycle. If actual dates are used, the effective seeding date must also be recorded.

7.2.1 Effective seeding date [YYYYMMDD]

Date when seeds were first moistened; this is the date of soaking for pre-soaked seed, or the date of sowing for dry seed sown onto a wet seedbed, or the date when rain or other moisture becomes available to seed sown dry on a dry seedbed.

7.2.2 First heading

(Wild species). Date on which the first flush of flowers is observed. It is specified either as the number of days from effective seeding date to first heading date (7.2.2.1) or as the date of effective seeding and date of first heading (7.2.1 and 7.2.2.2).

7.2.2.1 Number of days from effective seeding to first heading [d]

7.2.2.2 First heading date [YYYYMMDD]

7.2.3 Main heading

Date on which 80% of the plants are heading. It is specified either as the number of days from effective seeding date to main heading date (7.2.3.1) or as effective seeding date and main heading date (7.2.1 and 7.2.3.2).

7.2.3.1 Number of days from effective seeding to main heading date [d]

7.2.3.2 Main heading date [YYYYMMDD]

7.2.4 Maturity

Maturity is the date on which 80% of the grains on the panicles are fully ripened.

7.2.4.1 Number of days from effective seeding to maturity [d]

7.2.4.2 Maturity date [YYYYMMDD]

7.2.5 Life cycle

(Wild species). The completeness of plant growth in a growing season. Stage: after ratooning.

- 1 Annual
- 2 Perennial
- 3 Intermediate

7.3 Vegetative data**7.3.1 Coleoptile: anthocyanin colouration**

Observed in 6–7-day-old seedlings

- 0 Absent
- 1 Very weak
- 3 Weak
- 5 Medium
- 7 Strong

7.3.2 Seedling: height [cm]

Measured from the base of the shoot to the tip of the tallest leaf blade, to nearest cm. Average of 10 seedlings. Stage: 5-leaf stage, approximately 20 DAS².

Alternatively, *Oryza sativa* can be coded as follows:

- 3 Short (<30 cm)
- 5 Intermediate (~45 cm)
- 7 Tall (>60 cm)

² Days after sowing

7.3.3 Basal leaf sheath: colour

Colour of the outer surface of the leaf sheath. Stage: late vegetative (IRRI)

1	060	Green
2	084	Green with purple lines
3	081	Light purple
4	080	Purple

7.3.4 Leaf sheath: anthocyanin colouration

Presence and intensity of anthocyanin colouration on the outer surface of the sheath on the penultimate leaf. Stage: late vegetative

0	Absent
3	Weak
5	Medium
7	Strong

7.3.5 Leaf blade: presence/absence of anthocyanin colouration

Stage: late vegetative

0	Absent
1	Present

7.3.6 Leaf blade: distribution of anthocyanin colouration

Stage: late vegetative

(IRRI)		
1	086	On tips only
2	085	On margins only
3	089	In blotches
4	080	Even (uniform purple)

7.3.7 Leaf blade: intensity of green colour

Stage: late vegetative

(IRRI)		
0	0	No green colour visible due to anthocyanin
3	061	Light
5	060	Medium (green)
7	063	Dark

7.3.8 Leaf blade: attitude

(Cultivated species). Position of the tip of the blade relative to its base, scored on the leaf below the flag leaf. Stage: late vegetative prior to heading

1	Erect
5	Horizontal
7	Drooping

7.3.9 Leaf blade: pubescence

Assess both visually and by touch, rubbing fingers over the leaf surface from the tip downwards. Stage: late vegetative.

- 1 Glabrous (smooth—including ciliated margins)
- 2 Intermediate
- 3 Pubescent

7.3.9.1 Leaf blade pubescence on blade surface

(Wild species). Specify location of hairs present on the surface of the blade. Stage: late vegetative

- 1 Glabrous (no hairs)
- 2 Hairy on upper surface
- 3 Hairy on lower surface
- 4 Hairy on both sides

7.3.10 Leaf margin: pubescence

(Wild species). Assess pubescence of leaf margins. Stage: late vegetative

- 1 Glabrous (no hairs)
- 2 Hairy or ciliated

7.3.11 Auricle: colour

Stage: late vegetative

(IRRI)

- | | | |
|---|-----|----------------------|
| 0 | 0 | Absent (no auricles) |
| 1 | 011 | Whitish |
| 2 | 062 | Yellowish green |
| 3 | 080 | Purple |
| 4 | 081 | Light purple |
| 5 | 084 | Purple lines |

7.3.12 Collar: colour

Stage: late vegetative

(IRRI)

- | | | |
|---|-----|---------------------|
| 0 | 0 | Absent (collarless) |
| 1 | 060 | Green |
| 2 | 061 | Light green |
| 3 | 080 | Purple |
| 4 | 084 | Purple lines |

7.3.13 Ligule length [mm]

Measured on five samples from base of collar to the tip of the ligule of the penultimate leaf, i.e. the leaf below the flag leaf. Stage: after anthesis

7.3.14 Ligule shape

Different scoring systems are used for cultivated and wild species.

7.3.14.1 Ligule shape (cultivated species)

Stage: late vegetative. See Fig. 2.

- 0 Absent
- 1 Truncate
- 2 Acute to acuminate
- 3 2-cleft

7.3.14.2 Ligule shape (wild species)

Stage: after anthesis. See Fig. 3.

- 0 Absent
- 1 Fringe of hairs
- 2 Truncate
- 3 Obtuse or rounded
- 4 Emarginate
- 5 Acute
- 6 Acuminate
- 7 2-cleft

7.3.15 Ligule margin shape (wild species)

Stage: after anthesis.

- 1 Entire
- 2 Scalloped or toothed
- 99 Other (specify in descriptor 7.6, Notes)

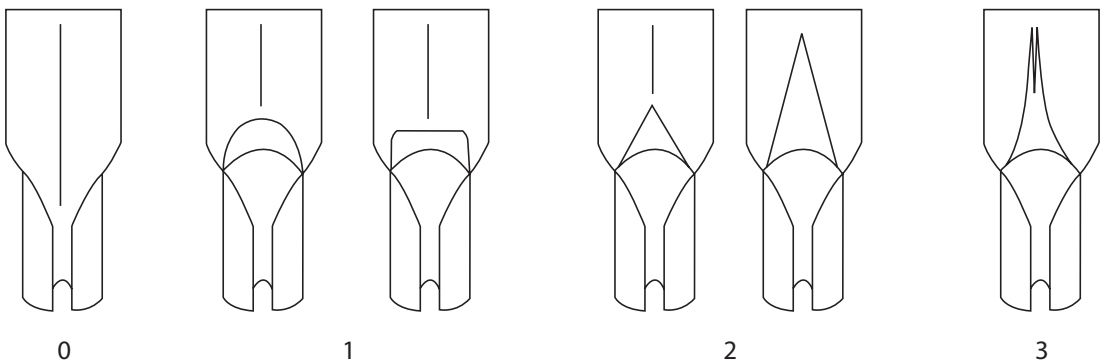


Fig. 2. Ligule shape (cultivated species)

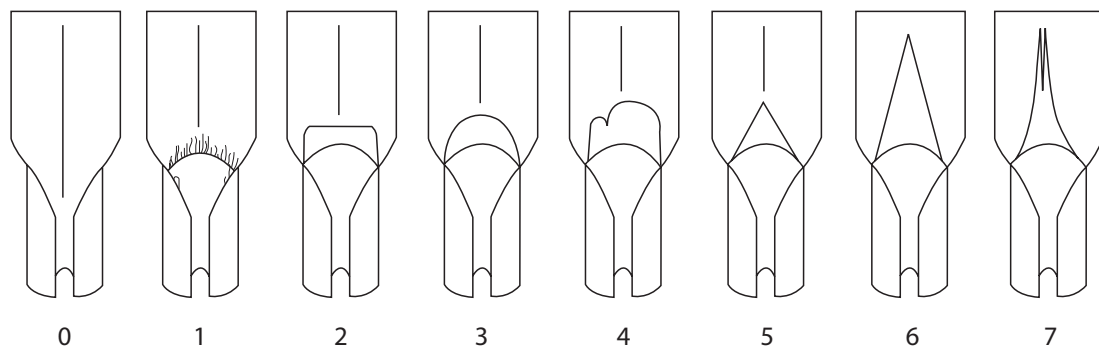


Fig. 3. Ligule shape (wild species)

7.3.15.1 Ligule margin hairiness

0	Absent
1	Present

7.3.16 Ligule pubescence

(Wild species). Visual assessment using hand lens. Stage: after anthesis

1	Glabrous
2	Partially hirsute: hairs covering less than 50% of the ligule
3	Mostly or generally hirsute: hairs covering more than 50% of the ligule

7.3.17 Ligule colour

Stage: late vegetative

(IRRI)

0	0	Absent (liguleless)
1	011	Whitish
2	062	Yellowish green
3	080	Purple
4	081	Light purple
5	084	Purple lines

7.3.18 Leaf blade: length [cm]

Measure the penultimate leaf (i.e. highest leaf below the flag leaf) on the main culm, from the ligule to the tip of the blade, on five representative plants. Calculate average to nearest cm.

Cultivated species: measure at early reproductive stage.

Wild species: measure 7 days after anthesis.

Alternatively, *Oryza sativa* can be coded as follows:

1	Very short	(<21 cm)
3	Short	(~30 cm)
5	Intermediate	(~50 cm)
7	Long	(~70 cm)
9	Very long	(>80 cm)

7.3.19 Leaf blade: width [cm]

Measure at the widest portion of the penultimate leaf (i.e. highest leaf below the flag leaf) on the main culm on five representative plants. Calculate average to nearest cm.

Cultivated species: measure at early reproductive stage.

Wild species: measure 7 days after anthesis.

Alternatively, *Oryza sativa* can be coded as follows:

3	Narrow	(<1 cm)
5	Intermediate	
7	Broad	(>2 cm)

7.3.20 Flag leaf: length [cm]

Measure length of the flag leaf, from the ligule to the tip of the blade, on five representative plants. Calculate average to nearest cm. Stage: 7 days after anthesis

7.3.21 Flag leaf: width [cm]

Measure width at the widest portion of the flag leaf on five representative plants. Calculate average to nearest cm. Stage: 7 days after anthesis

7.3.22 Flag leaf: attitude (early observation)

Measured near the collar. Angle of attachment between the flag leaf blade and the main panicle axis. Record the average of five samples. See Fig. 5.

Cultivated species: score at anthesis.

Wild species: score 7 days after anthesis.

1	Erect
3	Semi-erect (intermediate)
5	Horizontal
7	Descending

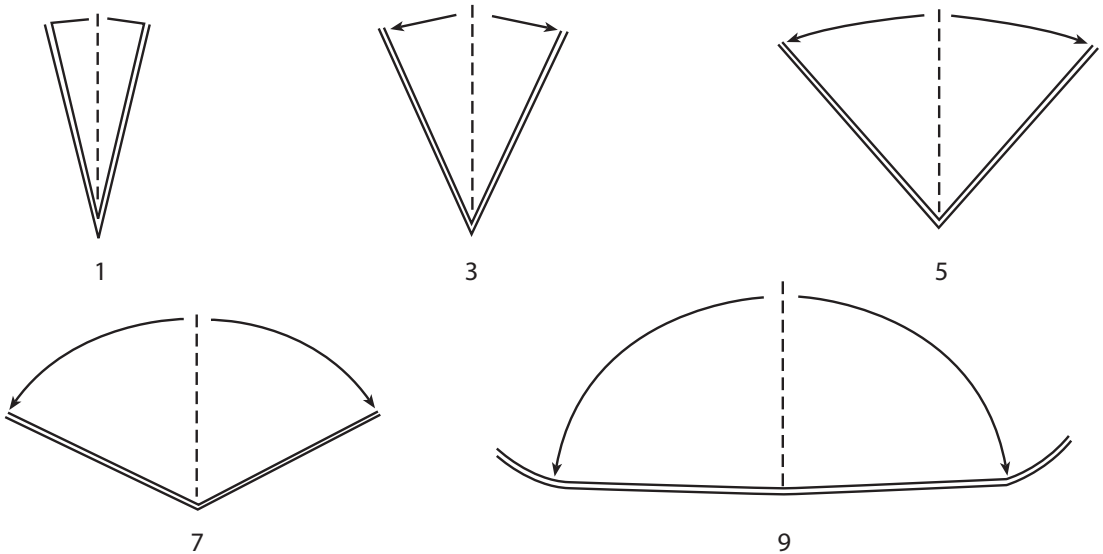


Fig. 4. Culm habit

7.3.23 Culm: habit

The estimated average angle of inclination of the base of the main culm from vertical. Stage: after flowering. See Fig. 4.

- 1 Erect ($<15^\circ$)
- 3 Semi-erect (intermediate) ($\sim 20^\circ$)
- 5 Open ($\sim 40^\circ$)
- 7 Spreading ($>60\text{--}80^\circ$, culms not resting on the ground)
- 9 Procumbent (culm or its lower part rests on ground surface)

7.3.24 Culm: kneeling ability

Prostrate cultivars only (i.e. with Culm habit = 9). Measured after flowering in conditions where culms have fallen flat due to receding water flow. The stems of cultivars with kneeling ability start to grow upright with 3 to 4 nodes and bear panicles.

- 0 Absent
- 1 Present

7.3.25 Culm: length [cm]

Measured from ground level to the base of the panicle. Record the average of five actual measurements, to the nearest cm. Stage: cultivated species after flowering to maturity; wild species 7 days after anthesis. See Fig. 6.

Alternatively, cultivated species can be coded as follows:

- 1 Very short (<50 cm)

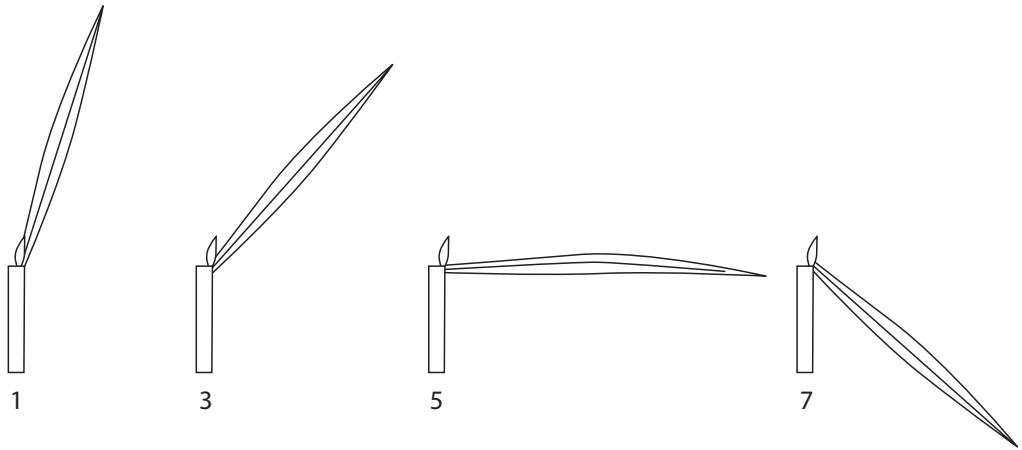


Fig. 5. Flag leaf attitude

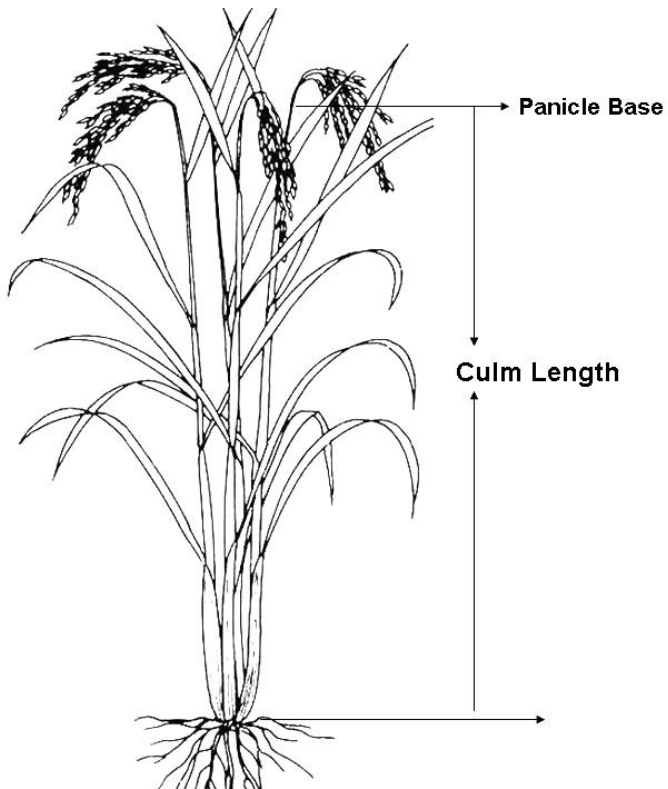


Fig. 6. Culm length

2	Very short to short	(51–70 cm)
3	Short	(71–90 cm)
4	Short to intermediate	(91–105 cm)
5	Intermediate	(106–120 cm)
6	Intermediate to long	(121–140 cm)
7	Long	(141–155 cm)
8	Long to very long	(156–180 cm)
9	Very long	(>180 cm)

7.3.26 Culm: number

Recorded as the total number of grain-bearing and non-bearing tillers on five plants (see descriptor 5.6, **Field spacing**). Stage: after anthesis to near maturity. Can be coded as follows:

3	Low	(<10 culms)
5	Intermediate	(~15 culms)
7	High	(>20 culms)

7.3.27 Culm: diameter at basal internode [mm]

Measured as the outer diameter of basal portion of the main culm.

Cultivated species: record average of three representative plants during flowering or at late reproductive stage.

Wild species: record average of five plants at late reproductive stage.

Alternatively, cultivated species can be coded as follows:

1	Thin	(<5 mm)
2	Thick	(≥5 mm)

7.3.28 Culm: anthocyanin colouration on nodes

The presence and distribution of purple colour from anthocyanin, observed on the outer surface of the nodes on the culm. Stage: after flowering to near maturity (IRRI)

0	0	Absent
1	080	Purple
2	081	Light purple
3	084	Purple lines

7.3.29 Culm: underlying node colour

The underlying colour of the outer surface of the nodes on the culm, ignoring any anthocyanin colouration. Stage: after flowering to near maturity (IRRI)

0	0	No underlying colour visible due to anthocyanin
1	041	Light gold
2	060	Green

7.3.30 Culm: internode anthocyanin

The presence and distribution of purple colour from anthocyanin, observed on the outer surface of the internodes on the culm. Stage: near colouration maturity

(IRRI)

0	0	Absent
1	080	Purple
2	084	Purple lines

7.3.31 Culm: underlying internode colouration

The underlying colour of the outer surface of the internodes on the culm, ignoring any anthocyanin colouration. Stage: near maturity

(IRRI)

0	0	No underlying colour visible due to anthocyanin
1	041	Light gold
2	060	Green

7.3.32 Culm: lodging resistance

Scored at maturity based on the observed degree of lodging.

1	Very weak (all plants flat)
3	Weak (most plants nearly flat)
5	Intermediate (most plants leaning about 45°)
7	Strong (most plants leaning about 20° from vertical)
9	Very strong (all plants vertical)

7.3.33 Culm: strength

Assessed by gently pushing the tillers back and forth at a distance of about 30 cm from the ground. This test gives some indication of stiffness and resilience. Stage: at harvest

1	Very weak
3	Weak
5	Intermediate
7	Strong
9	Very strong

7.3.34 Flag leaf: attitude (late observation)

(Cultivated species). Observed near the collar. Angle of attachment between the flag leaf blade and the main panicle axis. Record the average of five samples.

Stage: maturity

1	Erect
3	Semi-erect
5	Horizontal
7	Descending

7.3.35 Leaf: senescence

Estimated by observing all leaves below the flag leaf for their retention of greenness.

Stage: at harvest

- 1 Very early (all leaves lost their green colour before grain maturity)
- 3 Early (all leaves have lost their green colour at harvest)
- 5 Intermediate (one leaf still green at harvest)
- 7 Late (two or more leaves still green at harvest)
- 9 Very late (all leaves still green at harvest)

7.3.36 Rhizome and stolon: formation

(Wild species). Observe when plants are ready for harvest.

- 1 Vegetative crown
- 2 Vegetative crown and stolon
- 3 Vegetative crown and weak rhizomes
- 4 Vegetative crown, stolon and weak rhizomes
- 5 Strong rhizomes and no tubers
- 6 Strong rhizomes with tubers

7.4 Reproductive traits recorded before harvest**7.4.1 Male sterility**

Stage: at anthesis.

- 1 Effectively absent: <25% sterile pollen
- 2 Intermediate
- 3 Male sterile: >95% sterile pollen

7.4.2 Stigma: colour

Observed at anthesis (between 0900 and 1400) using a hand lens

(IRRI)

- | | | |
|---|-----|--------------|
| 1 | 010 | White |
| 2 | 061 | Light green |
| 3 | 030 | Yellow |
| 4 | 081 | Light purple |
| 5 | 080 | Purple |

7.4.3 Anther: length [mm]

(Wild species). Record the average of five samples. Stage: at anthesis

7.4.4 Anther: colour

(Wild species). Stage: at anthesis

(IRRI)

- | | | |
|---|-----|--------|
| 1 | 030 | Yellow |
| 2 | 050 | Brown |

7.4.5 Lemma and palea: colour (early observation)

Stage: after anthesis to hard dough stage (pre-ripening stage)
(IRRI)

1	010	White
2	012	Green-stripped white
3	042	Gold and gold furrows
4	052	Brown (tawny)
5	053	Brown spots on green
6	054	Brown furrows on green
7	056	Blackish brown
8	060	Green
9	062	Yellowish green
10	080	Purple
11	082	Reddish to light purple
12	083	Purple shade
13	090	Purple spots on green
14	091	Purple furrows on green
15	100	Black

7.4.6 Lemma: colour of apiculus (early observation)

Stage: cultivated species after anthesis to hard dough stage (pre-ripening stage);
wild species at anthesis

(IRRI)

1	010	White
2	020	Straw
3	052	Brown (tawny)
4	060	Green
5	070	Red
6	071	Red apex
7	080	Purple
8	087	Purple apex
9	100	Black

7.4.7 Lemma: anthocyanin colouration of area below apiculus
(early observation)

Stage: after anthesis to hard dough stage (pre-ripening stage)

0	Absent
1	Very weak
3	Weak
5	Medium
7	Strong

7.4.8 Awns: presence (wild species)

Stage: flowering to maturity

- 0 Absent
- 1 Partly awned
- 2 Fully awned

7.4.9 Awns: distribution (cultivated species)

The presence and distribution of awns along the panicle. Stage: flowering to maturity

- 0 None (awnless)
- 1 Tip only
- 2 Upper quarter only
- 3 Upper half only
- 4 Upper three-quarters only
- 5 Whole length

7.4.10 Awns: colour (early observation)

Stage: after anthesis

(IRRI)

- | | | |
|---|-----|------------------|
| 0 | 0 | Absent (awnless) |
| 1 | 011 | Whitish |
| 2 | 020 | Straw |
| 3 | 040 | Gold |
| 4 | 052 | Brown (tawny) |
| 5 | 061 | Light green |
| 6 | 070 | Red |
| 7 | 080 | Purple |
| 8 | 100 | Black |

7.4.11 Awn length [mm]

Record the average length of 10 representative spikelets.

Cultivated species: measure the longest awn. Stage: maturity

Wild species: measure random awns. Stage: after anthesis

Alternatively, cultivated species can be coded as follows:

- 0 None (awnless)
- 1 Very short (<5 mm)
- 3 Short (~8 mm)
- 5 Intermediate (~15 mm)
- 7 Long (~30 mm)
- 9 Very long (>40 mm)

7.4.12 Awns: thickness [mm]

(Wild species). Record the average width of 10 representative spikelets, at 1 cm from the apiculus of the spikelet. Stage: after anthesis

7.4.13 Panicle: arrangement of primary branches

(Wild species). Stage: after anthesis

- 1 Whorled
- 2 Alternate

7.4.14 Panicle: number of basal primary branches

Recorded from 5 panicles on wild species only. The number of primary panicle branches attached to the basal whorl of the panicle. Stage: after anthesis

7.4.15 Panicle: distance from base to lowest spikelet insertion [mm]

(Wild species). Record the average of five representative panicles when fully exerted.

7.4.16 Panicle: texture of main axis

(Wild species). Assess by rubbing fingers from the base towards the tip of the panicle axis. Stage: at full panicle exertion

- 1 Scabrous
- 2 Smooth

7.4.17 Panicle: number per plant

Record the number of panicles per plant (see descriptor 5.6, **Field spacing**). Stage: early ripening

Alternatively, panicle number can be coded as follows:

- 3 Low
- 5 Intermediate
- 7 High

7.4.18 Panicle: length [cm]

(Wild species). Length of main axis of panicle measured from the panicle base to the tip. Record the average of five representative plants.

Stage: 7 days after anthesis or upon full panicle exertion

7.4.19 Panicle: attitude of main axis

Stage: near maturity

- 1 Upright
- 2 Semi-upright
- 3 Slightly drooping
- 4 Strongly drooping

7.4.20 Panicle: attitude of branches

The compactness of the panicle, classified according to its mode of branching, angle of primary branches, and spikelet density. See Fig. 7.

Stage: cultivated species, near maturity; wild species, 7 days after anthesis

- 1 Erect (compact panicle)
- 3 Semi-erect (semi-compact panicle)
- 5 Spreading (open panicle)
- 7 Horizontal
- 9 Drooping

7.4.21 Panicle: secondary branching

The abundance and distribution of spikelets borne on secondary branches of the panicle. Stage: near maturity. See Fig. 8.

- 0 Absent
- 1 Sparse (~1 secondary branch per primary branch. Most spikelets borne directly on primary branches)
- 2 Dense (~2-3 secondary branches per primary branch. ~50% of spikelets borne directly on primary branches)
- 3 Clustered (~3-4 secondary branches per primary branch. All spikelets on secondary branches, giving a clustered appearance)

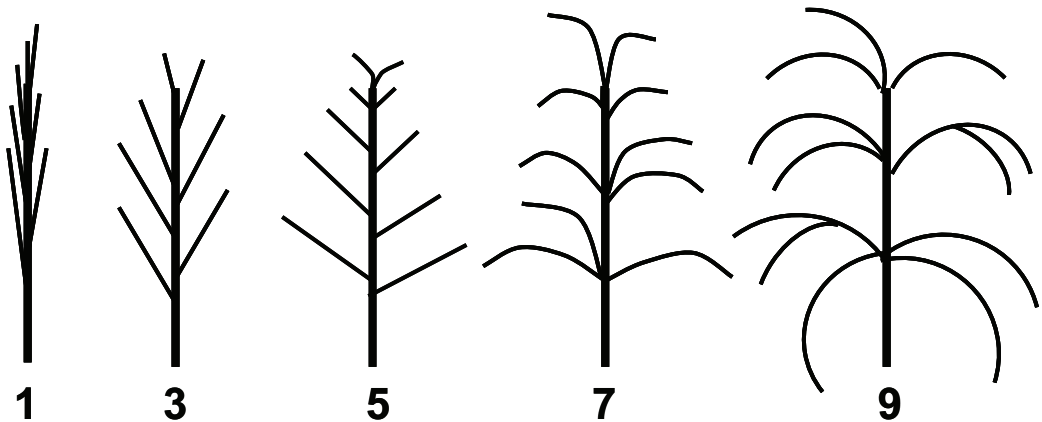


Fig. 7. Attitude of panicle branches



Fig. 8. Secondary branching of panicle

7.4.22 Panicle: exertion

Extent to which the panicle is exerted above the flag leaf sheath. Stage: near maturity. See Fig. 9.

- 1 Enclosed (panicle is partly or entirely enclosed within the leaf sheath of the flag leaf blade)
- 3 Partly exerted (panicle base is slightly beneath the collar of the flag leaf blade)
- 5 Just exerted (panicle base coincides with the collar of the flag leaf blade)
- 7 Moderately well exerted (panicle base is above the collar of the flag leaf blade)
- 9 Well exerted (panicle base appears well above the collar of the flag leaf blade)

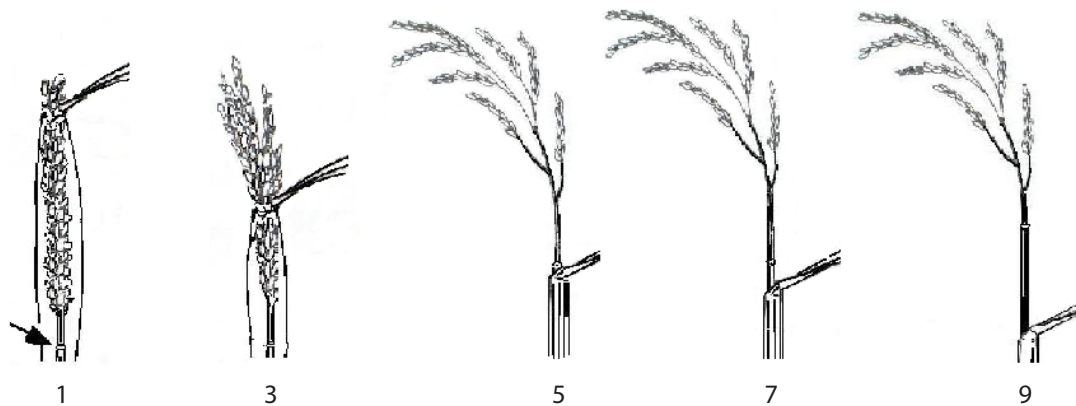


Fig. 9. Panicle exertion

7.4.23 Panicle: shattering

Observed as the extent to which grains have shattered from the panicle. Stage: at maturity or harvest

1	Very low	(<1%)
3	Low	(~3%)
5	Moderate	(~15%)
7	High	(~35%)
9	Very high	(>50%)

7.5 Traits recorded after harvest

7.5.1 Panicle: length (late observation)

(Cultivated species). Length of main axis of panicle measured from base to the tip.

Record the average of five representative plants.

Alternatively, lengths can be coded as follows:

1	Very short	(<11 cm)
3	Short	(~15 cm)
5	Medium	(~25 cm)
7	Long	(~35 cm)
9	Very long	(>40 cm)

7.5.2 Panicle: threshability

(Cultivated species). Determined by grasping the panicle with the hand, applying a slight rolling pressure with the palm and fingers, and assessing the percentage of grains that are removed by the action.

1	Difficult (few or no grains removed)
2	Intermediate (25–50% of grains removed)
3	Easy (>50% of grains removed)

7.5.3 Awn colour (late observation)
(IRRI)

0	0	Absent (awnless)
1	020	Straw
2	040	Gold
3	052	Brown (tawny)
4	070	Red
5	080	Purple
6	100	Black

7.5.4 Lemma and palea pubescence

Visual assessment of the presence and distribution of mature grains using hand lens.

1	Glabrous
2	Hairs on lemma keel
3	Hairs on upper portion
4	Short hairs
5	Long hairs (velvety)

7.5.5 Lemma and palea colour (late observation)
(IRRI)

1	010	White
2	020	Straw
3	042	Gold and gold furrows
4	052	Brown (tawny)
5	053	Brown spots
6	054	Brown furrows
7	080	Purple
8	082	Reddish to light purple
9	090	Purple spots
10	091	Purple furrows
11	100	Black

7.5.6 Lemma: anthocyanin colouration of keel

0	Absent
1	Very weak
3	Weak
5	Medium
7	Strong

7.5.7 Lemma: anthocyanin colouration of area below apiculus (late observation)

0	Absent
---	--------

- 1 Very weak
- 3 Weak
- 5 Medium
- 7 Strong

7.5.8 Lemma: colour of apiculus (late observation)
(IRRI)

- 1 010 White
- 2 020 Straw
- 3 052 Brown (tawny)
- 4 060 Green
- 5 070 Red
- 6 071 Red apex
- 7 080 Purple
- 8 087 Purple apex
- 9 100 Black

7.5.9 Lemma: shape of apiculus
(Cultivated species). Stage: after harvest

- 1 Pointed
- 2 Curved

7.5.10 Sterile lemma length [mm]

Record the average length of five spikelets. For spikelets with symmetrical sterile lemmas (i.e. sterile length the same on both sides), record the length here. For spikelets with asymmetrical sterile lemmas (i.e. sterile lemma on one side longer than that on the other), record here only the length of the shorter sterile lemma (see 7.5.11 for the longer sterile lemma).

May be coded as:

- 3 Short
- 5 Medium
- 7 Long
- 9 Extra long

7.5.11 Longer sterile lemma length [mm]

(Only for spikelets with asymmetrical sterile lemmas). Record the average length of the longer sterile lemma on five spikelets.

May be coded as:

- 3 Short
- 5 Medium
- 7 Long
- 9 Extra long

7.5.12 Sterile lemma shape

(Wild species).

- 0 Absent
- 1 Linear (long and slender)
- 2 Subulate or setaceous (linear and tapering to a fine point, set with or consisting of bristles)
- 3 Triangular (and very small)

7.5.13 Sterile lemma: colour

Observe five representative plants.

(IRRI)

- | | | |
|---|-----|--------|
| 1 | 020 | Straw |
| 2 | 040 | Gold |
| 3 | 070 | Red |
| 4 | 080 | Purple |

7.5.14 Spikelet: fertility

The abundance of well-developed spikelets as a percentage of the total number of spikelets on five representative panicles. May be coded as:

- 1 Completely sterile (0%)
- 2 Highly sterile (1–49%)
- 3 Partly sterile (50–74%)
- 4 Fertile (75–90%)
- 5 Highly fertile (>90%)

7.5.15 Grain: length [mm]

Measured as the distance from the base of the lowermost glume to the tip (apiculus) of the fertile lemma or palea, whichever is longer. On awned cultivars, measure to a point comparable to the tip of the apiculus (exclude the awn). Preferably, measure with calliper or photo-enlarger. Average of 10 representative grains.

7.5.16 Grain: width [mm]

Measured as the distance across the fertile lemma and palea at the widest point. Preferably, measure with calliper or photo-enlarger. Average of 10 representative grains.

7.5.17 Grain: thickness [mm]

(Wild species). Preferably, measure with a calliper or photo-enlarger. Average of 10 representative grains. Stage: after harvest

7.5.18 Grain: 100-grain weight [g]

(Cultivated species). Random sample of 100 well-developed, whole grains, dried to 13% moisture content. Weigh on a precision balance.

7.5.19 Grain: 10-grain weight [g]

(Wild species). (10-grain samples are taken because of the low seed production of wild rice.) Random sample of 10 well-developed, whole grains, dried to 13% moisture content. Weigh on a precision balance. Stage: post-harvest

7.5.20 Caryopsis: length [mm]**7.5.21 Caryopsis: width [mm]****7.5.22 Caryopsis: shape**

- 1 Round
- 2 Semi-round
- 3 Half spindle-shaped
- 4 Spindle-shaped
- 5 Long spindle-shaped

7.5.23 Caryopsis: pericarp colour

(IRRI)

- | | | |
|---|-----|-----------------|
| 1 | 010 | White |
| 2 | 051 | Light brown |
| 3 | 055 | Speckled brown |
| 4 | 050 | Brown |
| 5 | 070 | Red |
| 6 | 088 | Variable purple |
| 7 | 080 | Purple |

7.5.24 Endosperm type

By visual observation, two types of endosperm of polished rice are distinguishable. In glutinous rice, which does not have amylose, the endosperm appears a waxy white. In non-glutinous rice, which contains amylose, the endosperm appears cloudy and translucent.

- 1 Non-glutinous (non-waxy)
- 2 Intermediate
- 3 Glutinous (waxy)

7.6 Notes

Specify here any additional information.

EVALUATION

8. Plant descriptors

8.1 Grain cooking and quality traits

8.1.1 Lemma: phenol reaction

Place hulls from 10 grains into a petri dish of 5 cm diameter, and add 5 ml of 1.5% phenol solution; cover the petri dish, and keep at room temperature for 1 day. Record the reaction of the lemmas.

- 0 No reaction
- 3 Light
- 5 Medium
- 7 Dark

8.1.2 Caryopsis scent

From cooked kernel. Use freshly harvested grain. A molecular marker for fragrance is described in Section 12.3, **Fragrance**.

- 0 Non-scented
- 1 Lightly scented
- 2 Scented

8.1.3 Endosperm amylose content [%]

Amylose content of all cultivars of low amylose and many of intermediate amylose is sensitive to high temperatures during grain-filling. Molecular markers for classifying amylose are listed in Section 12.1, **Amylose content**.

- 0 Waxy-glutinous (<3)
- 1 Very low (~9)
- 3 Low (~17)
- 5 Intermediate (~20)
- 7 High (~23)
- 9 Very high (>25)

8.1.4 Gelatinization temperature by alkali-digestion value

Gelatinization temperature increases in japonica cultivars when grain-filling occurs under high temperatures. Molecular markers are described in Section 11.2 for classifying gelatinization temperature. This test is simpler but less precise than the alternative test described in Section 8.1.5.

State of each grain (use 7 polished grains) after soaking for 16h in 1.7% KOH	Alkali digestion	Gelatinization temperature
1 Not affected but chalky	Low	High (>74°C)
2 Swollen		
3 Swollen with collar incomplete and narrow	Intermediate	Intermediate (70-74°C)
4 Swollen with collar complete and wide		
5 Split or segmented with collar complete and wide		
6 Dispersed, merging with collar	High	Low (<70°C)
7 Completely dispersed and cleared		

8.1.5 Gelatinization temperature by differential scanning calorimetry

Differential scanning calorimetry (DSC) measures the energy required to melt starch crystals and reports the onset temperature, peak temperature, conclusion temperature and enthalpy of gelatinization. The peak temperature provides a precise measure of gelatinization temperature. GT falls into two groups when DSC is used, with peak temperatures of 60–74°C or 75–85°C. See Fig. 10.

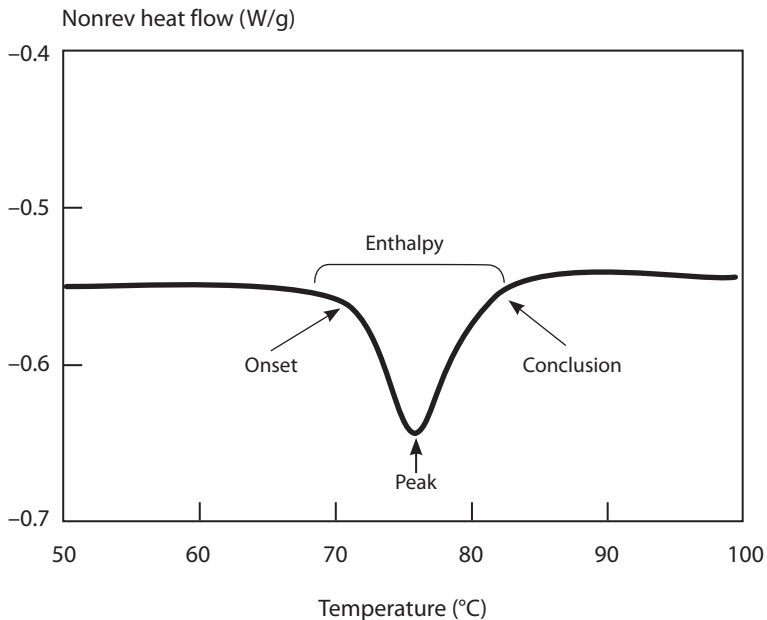


Fig. 10. Gelatinization temperature by alkali-digestion value

8.1.6 Gel consistency

Ground rice (0.1 g) is placed in a test tube with thymol blue (0.025% in ethanol, 0.2 ml) and KOH (0.2N, 2 ml). The tube is shaken to ensure contents are mixed, boiled (8 min), rested (5 min) and then placed in an ice-bath (15 min). Cooled tubes are laid flat on graph paper for 1 hour, and then the distance that the gel travels is measured. Age of the rice, degree of milling and operator skill are key factors that affect reproducibility. Standards should be included: IR48 (85–90 mm), IR32 (72–75 mm) and IR42 (30–32 mm).

Scale	Gel length	Gel consistency type
1	81–100 mm	Soft
2	61–80 mm	Soft
3	41–60 mm	Intermediate
4	36–40 mm	Hard
5	<36 mm	Hard

8.1.7 Brown rice protein content [% DW]**8.1.8 Lysine content [% DW]****8.1.9 Parboiling loss [% DW]**

Percentage of solids lost when parboiled.

8.1.10 Elongation ratio

Ratio of cooked rice length to milled rice length.

8.2 Notes

Specify here any additional information.

9. Abiotic stress sensitivity

Scored under artificial and/or natural conditions, which should be clearly specified. The code numbers of IRRI-SES for the corresponding characteristic are indicated beside the descriptor name between brackets [IS-] for easy reference. These codes belong to the Standard Evaluation System for Rice (INGER, Genetic Resources Centre, IRRI, July 1996, see **Bibliography**). These are coded on a sensitivity scale from 1 to 9:

0	No visible sign of sensitivity
1	Very low or almost no visible sign of sensitivity
3	Low
5	Intermediate
7	High
9	Very high

- 9.1 Cold** [IS-75]
- 9.2 Heat** [IS-76]
- 9.3 Drought** [IS-80]
- 9.4 Alkali injury and salt injury** [IS-70-71]
- 9.5 Iron toxicity** [IS-72]
- 9.6 Phosphorus deficiency** [IS-73]
- 9.7 Zinc deficiency** [IS-74]
- 9.8 Flood or submergence** [IS-86]
- 9.9 Notes**
Specify here any additional information.

10. Biotic stress sensitivity

In each case, state the origin of the infestation or infection (natural, field inoculation or laboratory) in descriptor **10.4, Notes**. The code numbers of IRRI-SES of the corresponding characteristic are indicated beside the descriptor name between brackets [IS-] for easy reference. These codes belong to the Standard Evaluation System for Rice (INGER, Genetic Resources Center, IRRI, July 1996, see **Bibliography**). These are coded on a sensitivity scale from 1 to 9:

- 1 Very low or no visible sign of sensitivity
- 3 Low
- 5 Intermediate
- 7 High
- 9 Very high

10.1 Diseases

	Causal agent	Disease or common name	
10.1.1	<i>Magnaporthe grisea</i>	Leaf blast	[IS-30]
10.1.2	<i>Magnaporthe grisea</i>	Panicle blast	[IS-31]
10.1.3	<i>Cochliobolus miyabeanus</i>	Brown spot	[IS-32]
10.1.4	<i>Sphaerulina oryzae</i>	Narrow brown leaf spot	[IS-33]
10.1.5	<i>Xanthomonas oryzae</i> pv. <i>oryzicola</i>	Bacterial leaf streak	[IS-33]
10.1.6	<i>Monographella albescens</i>	Leaf scald	[IS-34]
10.1.7	<i>Xanthomonas oryzae</i> pv. <i>oryzae</i>	Bacterial blight	[IS-35]

10.2 Diseases caused by viruses and mycoplasma-like organisms [IS-36]

	Causal agent	Disease or common name	
10.2.1	Rice grassy stunt virus 1 (RGSV1) and rice grassy stunt virus 2 (RGSV2)	Rice grassy stunt 1 and 2 disease	
10.2.2	Rice ragged stunt virus (RRSV)	Rice ragged stunt disease	
10.2.3	Mycoplasma	Yellow dwarf	
10.2.4	Rice yellow mottle virus (RYMV)	Rice yellow mottle	
10.2.5	Rice hoja blanca virus (RHBV)	Rice hoja blanca	
10.2.6	<i>Thanatephorus cucumeris</i>	Sheath blight (ShB)	[IS-37]
10.2.7	<i>Sarocladium oryzae</i>	Sheath rot (ShR)	[IS-38]
10.2.8	<i>Sarocladium</i> , <i>Bipolaris</i> , <i>Alternaria</i>	Grain discolouration	[IS-39]
10.2.9	<i>Ustilaginoidea virens</i>	False smut (FSm)	[IS-40]
10.2.10	<i>Tilletia barclayana</i>	Kernel smut (KSm)	[IS-40]
10.2.11	<i>Balansia oryzae-sativae</i>	Udbatta disease (UDb)	[IS-41]
10.2.12	<i>Gibberella fujikuroi</i>	Bakanae disease	[IS-41]
10.2.13	<i>Magnaporthe salvinii</i>	Stem rot (SR)	[IS-42]
10.2.14	<i>Ditylenchus angustus</i>	Ufra (U)	[IS-43]

10.3 Insects

	Causal agent	Common name	
10.3.1	<i>Nilaparvata lugens</i>	Brown planthopper (BPH)	[IS-60]
10.3.2	<i>Nephotettix</i> spp.	Green leafhopper (GLH)	[IS-61]
10.3.3	<i>Sogatella furcifera</i>	Whitebacked planthopper (WBPH)	[IS-62]
10.3.4	<i>Tagosodes orizicolus</i>	Rice delphacid (RDel)	[IS-62]
10.3.5	<i>Chilo suppressalis</i>	Stem borer (SB)	[IS-63]
10.3.6	<i>Cnaphalocrosis medinalis</i>	Leaf folder (LF)	[IS-64]
10.3.7	<i>Orseolia oryzae</i>	Gall midge (GM)	[IS-65]
10.3.8	<i>Nymphula depunctalis</i>	Caseworm (CS)	[IS-66]
10.3.9	<i>Hydrellia philippina</i>	Rice whorl maggot (RWM)	[IS-67]
10.3.10	<i>Leptocorisa oratorius</i>	Rice bug (RB)	[IS-68]
10.3.11	<i>Stenchaetothrips biformis</i>	Thrips	[IS-69]

10.4 Notes

Specify here any additional information.

11. Biochemical markers

Specify methods used and cite reference(s). Refer to *Descriptors for genetic markers technologies*, available in pdf (portable document format) from the Bioversity Web site (www.bioversity.cgiar.org) or by email request to bioversity-publications@cgiar.org.

12. Molecular markers

For general standards for molecular markers, refer to *Descriptors for genetic markers technologies*, available in pdf from the Bioversity Web site (www.bioversity.cgiar.org) or by email request to bioversity-publications@cgiar.org.

The descriptors below are for known markers for specific traits in rice

12.1 Amylose content

(Isshiki *et al.* 1998; Bergman *et al.* 2001). A microsatellite marker associated with amylose content identifies the number of dinucleotide repeats of cytosine and thiamine (CT)_n on exon 1 of *Granule Bound Starch Synthase 1 (GBSS1)*, which is the gene responsible for amylose synthesis. CT_n ranges from CT₈ – CT₂₂, with several alleles occurring in each of the three categories of amylose content. A single nucleotide polymorphism (SNP), replacing G with T, at the splice site of intron 1 of *GBSS1* determines whether the rice is high and intermediate amylose (G) or low amylose (T). Using CT_n in combination with G/T predicts amylose content, indicates the quality of the rice and can often confirm the identity of a rice variety. CT_n can be detected by gel electrophoresis of products from a polymerase chain reaction (PCR). G/T can be detected by gel electrophoresis of the products of a restriction enzyme assay (*AccI*).

12.2 Gelatinization temperature

(Waters *et al.* 2005). Differences in the activity of the enzyme Starch Synthase 11a (*SS11a*) contributes the most to variability in gelatinization temperature. Three SNPs on exon 8 of the *SS11a* gene divide rice into four haplotypes. For two of the haplotypes, gelatinization temperature is below 75°C (measured by DSC); for the other two haplotypes, gelatinization temperature is above 75°C (measured by DSC). The SNPs can be detected by gel electrophoresis of PCR products.

12.3 Fragrance

(Bradbury *et al.* 2005). Almost all aromatic rice carries an inactive allele of betaine aldehyde dehydrogenase 11 (*BAD11*) and almost all non-aromatic rice carries the active allele of the *BAD11* gene. The inactive allele is missing 8 basepairs (bp) in the *BAD11* gene. The 8-bp deletion can be detected by gel electrophoresis of PCR products.

13. Cytological characters

13.1 Chromosome number

Determined through pollen samples taken at booting stage or from the root tip of germinating seedlings.

13.2 Ploidy level

(e.g. aneuploid or structural rearrangement)

13.3 Other cytological characters

14. Identified genes

Describe any known specific mutant present in the accession.

BIBLIOGRAPHY

- Alercia A, Diulgheroff S, Metz T. 2001. Source/contributor: FAO (Food and Agriculture Organization of the United Nations), IPGRI (International Plant Genetic Resources Institute). In: List of Multicrop Passport Descriptors. www.biodiversity.cgiar.org
- Bergman CJ, Delgado JT, McClung AM, Fjellstrom RG. 2001. An improved method for using a microsatellite in the rice waxy gene to determine amylose class. *Cereal Chemistry* 783:257–260.
- Bradbury LMT, Henry RJ, Jin QS, Reinke RF, Waters DLE. 2005. A perfect marker for fragrance genotyping in rice. *Molecular Breeding* 16:279–283.
- De Vicente C, Alercia A, Metz T. 2004. Source/contributor: IPGRI (International Plant Genetic Resources Institute). In: Descriptors for Genetic Markers Technologies. www.biodiversity.cgiar.org
- FAO. 1990. Guidelines for Soil Profile Description, 3rd edition (revised). Food and Agriculture Organization of the United Nations, International Soil Reference and Information Centre, Land and Water Development Division. FAO, Rome.
- Glaszmann JC. 1987. Isozymes and classification of Asian rice varieties. *Theoretical and Applied Genetics* 74:21–30.
- IBPGR-IRRI Rice Advisory Committee. 1980. Descriptors for rice *Oryza sativa* L. 21 p.
- IRRI (International Rice Research Institute). 1996. International Network for Genetic Evaluation of Rice (INGER), Standard Evaluation System for Rice, 4th edition, July 1996. Manila, Philippines.
- IRRI (International Rice Research Institute). 2006. Bringing hope, improving lives: strategic plan, 2007-2015. Manila, Philippines. 61 p.
- Isshiki M, Morino K, Nakajima M, Okagaki RJ, Wessler SR, Izawa, Shimamoto K. 1998. A naturally occurring functional allele of the rice waxy locus has a GT to TT mutation at the 5' splice site of the first intron. *Plant Journal* 15:133–138.
- Kornerup A, Wanscher JH. 1984. *Methuen Handbook of Color*. Third edition. Methuen, London.
- Lawrence GHM. 1955. *An Introduction to Plant Taxonomy*. New York.
- Munsell Color. 1975. *Munsell Soil Color Chart*. Munsell Color, Baltimore, MD, USA.
- Munsell Color. 1977. *Munsell Color Charts for Plant Tissues*, 2nd edition, revised. Munsell Color, Macbeth Division of Kollmorgen Corporation, Baltimore, MD, USA.
- Rana RS, Sapro RL, Agrawal RC, Rajeev Gambhir. 1991. *Plant Genetic Resources. Documentation and Information Management*. National Bureau of Plant Genetic Resources (Indian Council of Agricultural Research). New Delhi, India.
- Royal Horticultural Society. 1966, c. 1986. *R.H.S. Colour Chart* (edn. 1, 2). Royal Horticultural Society, London.

- Stearn WT. 1995. Botanical Latin. Fourth Edition. David & Charles Publishers, Newton Abbot, UK.
- UPOV. 2004. Rice (*Oryza sativa* L.): guidelines for the conduct of tests for distinctness, uniformity and stability. TG/16/8. International Union for the Protection of New Varieties of Plants (UPOV), Geneva.
- van Hintum ThJL. 1993. A computer compatible system for scoring heterogeneous populations. Genetic Resources and Crop Evolution 40:133–136.
- Waters DLE, Henry RJ, Reinke RF, Fitzgerald MA. 2006. Gelatinisation temperature of rice explained by polymorphisms in starch synthase IIa. Plant Biotechnology Journal 4:115–122.

CONTRIBUTORS

Coordinators

Dr Ruaraidh Sackville Hamilton
 Head, T.T. Chang Genetic Resources Center
 (GRC)
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: r.hamilton@cgiar.org

Ms Socorro Almazan
 T.T. Chang Genetic Resources Center (GRC)
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: m.almazan@cgiar.org

Ms Maria Celeste Banaticla
 T.T. Chang Genetic Resources Center (GRC)
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: m.banaticla@cgiar.org

Dr Melissa Fitzgerald
 Head, Grain Quality, Nutrition, and Postharvest
 Center
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: m.fitzgerald@cgiar.org

Dr Edwin Javier
 Plant Breeding, Genetics, and Biotechnology
 Division
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: e.javier@cgiar.org

Ms Elizabeth Naredo
 T.T. Chang Genetic Resources Center (GRC)
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: e.naredo@cgiar.org

Mr Renato Reaño
 T.T. Chang Genetic Resources Center (GRC)
 International Rice Research Institute (IRRI)
 DAPO Box 7777
 Metro Manila
 Philippines
 E-mail: r.reano@cgiar.org

Reviewers

Dr Murthi Anishetty
 #888 Siddartha Nagar (Plot No. 91),
 P.O. Vengal Rao Nagar, Hyderabad (A.P.) 500 038
 India
 E-mail: a.murthi@cgiar.org or
 nmurthi_anishetty@yahoo.co.in

Dr Eklou Attiogbevi-Somado
 Genetic Resources Unit
 WARDA, Africa Rice Center
 S/c IITA Benin - 01 BP 3021 Cotonou
 Benin

Dr Bhag Mal
 South Asia Coordinator
 Bioversity, c/o CG Centres Block
 Ch Devi Lal National Agriculture Science Centre
 (NASC)
 Dev Prakash Shastri Marg, Pusa campus
 New Delhi 110012
 India
 E-mail: b.mal@cgiar.org

Ms Iva Faberova
 Genebank Manager
 Research Institute of Crop Production
 Drnovska 507 161 06 Praha 6 -Ruzyně
 Czech Republic
 E-mail: faberova@vurv.cz

Dr Helmut Knüpffer
 Genebank Department,
 Institute of Plant Genetics and Crop Plant
 Research (IPK)
 Correns str. 3 D-06466
 Gatersleben
 Germany
 E-mail: knupffer@ipk-gatersleben.de

Dr Laurie Lewin
Head, Rice CRC
F1832 Colando Mail
Leeton NSW 2705
Australia
E-mail: laurie.lewin@bigpond.com

Dr Paul Quek
Scientist/Regional Office for APO
Bioversity, PO Box 236, UPM Post Office,
Serdang
43400 Selangor Darul Ehsan
Malaysia
E-mail: p.quek@cgiar.org

Dr Edilberto D. Redoña
Senior Scientist (INGER)
Plant Breeding, Genetics, and Biotechnology
Division
International Rice Research Institute (IRRI)
DAPO Box 7777
Metro Manila
Philippines
E-mail: e.redona@cgiar.org

Dr Inés Sánchez
Population Genetics and Evolution
Head of the Genetic Resources Unit
WARDA, Africa Rice Center
S/c IITA Benin - 01 BP 3021 Cotonou
Benin
E-mail: i.sanchez@cgiar.org

Kayode Sanni
Genetic Resources Unit
WARDA, Africa Rice Center
S/c IITA Benin - 01 BP 3021 Cotonou
Benin

Abdoulaye Sanwidi
Data Manager
Genetic Resources Unit
WARDA, Africa Rice Center
S/c IITA Benin - 01 BP 3021 Cotonou
Benin

Dr Xavier Scheldemann
Conservation and Use of Neotropical PGR
Bioversity, c/o CIAT
Apartado Aéreo 6713
Cali
Colombia
E-mail: x.scheldemann@cgiar.org

Dr Wang Shumin
Deputy Director
Institute of Crop Germplasm Resources
Chinese Academy of Agricultural Sciences
12 Zhongguancun Nandajie, Beijing 100081
China
E-mail: smwang@mail.caas.net.cn

Albert Tchamba
Telecom and Database Manager
Genetic Resources Unit
WARDA, Africa Rice Center
S/c IITA Benin - 01 BP 3021 Cotonou
Benin

Daniel Tia
Germplasm Specialist
Genetic Resources Unit
WARDA, Africa Rice Center
S/c IITA Benin - 01 BP 3021 Cotonou
Benin

ACKNOWLEDGEMENTS

Bioversity, IRRI and WARDA wish to place on record their sincere thanks to the numerous rice workers around the world who have contributed directly or indirectly to the development of **Descriptors for wild and cultivated rice.**

Ms Adriana Alercia coordinated and managed the production of the publication. Ms Audrey Chaunac provided assistance during the production process. Ms Patrizia Tazza prepared the cover and designed the layout. IRRI Communication and Publications Services staff did the layout.

Technical and scientific advice provided by Ramanatha Rao, Michael Jackson and Adelaida Pua Alcantara is gratefully acknowledged.

ANNEX I. List of highly discriminating Bioversity-IRRI descriptors for rice

Bioversity-IRRI Descriptor

Number	Name
7.2.3	Main heading
7.3.11	Auricle: colour
7.3.22	Flag leaf: attitude (early observation)
7.3.25	Culm: length
7.3.28	Culm: anthocyanin colouration on the nodes
7.3.29	Culm: underlying node colour
7.3.34	Flag leaf: attitude (late observation)
7.4.2	Stigma: colour
7.4.6	Lemma: colour of apiculus (early observation)
7.4.9	Awns distribution
7.4.18	Panicle: length
7.4.19	Panicle: attitude of main axis
7.4.20	Panicle: attitude of branches
7.5.4	Lemma and palea: pubescence
7.5.10	Sterile lemma: length
7.5.11	Longer sterile lemma length
7.5.13	Sterile lemma: colour
7.5.20	Caryopsis: length
7.5.22	Caryopsis: shape
7.5.23	Caryopsis: pericarp colour
8.1.2	Caryopsis scent

ANNEX II. The IRRI standard colour coding system used for all colour descriptors and its correspondence to published standard colour charts

IRRI code	Colour states	Methuen Handbook of Colours	Royal Horticultural Society (RHS) Colour Chart
010	White	A1	
011	Whitish	1-3 A2	155A-D; 157C; 158CD
020	Straw	2A2-3; 3A2-3	158AB; 159ABC; 160BCD; 161CD; 162CD; 63D; 2C; 4C;
030	Yellow	1A7-8; 2A7-8	1-4AB; 5-6ABC; 7BCD; 8-9AB
040	Gold	3-4 AB8	13A; 14AB; 15AB; 16A; 17AB; 21AB
041	Light gold	3A6-7	18A; 19A; 20AB; 21CD;
050	Brown	5E7-8; 6-7E7-8	172A; 173A; 174AB; 175CD; 176D; 177CD; 178D
051	Light brown	5-6CD6-8	163A; 164BC; 165CD; 166D
052	Brown (tawny)	6-7DE7-8	175AB; 176AB; 177A; 178AB;
056	Blackish brown	5-6F5-8	200ABCD
060	Green	26ABC7-8; 27ABC8	129A; 131D; 132C; 134A;
061	Light green	26AB5-6; 27AB6-7; 28AB6-8;	129A; 130A; 134B;
062	Yellowish green	29-30ABC7-8	134B; 140AB; 141D; 142A;
063	Dark green	27E7-8; 28F6-8; 29F8	126A; 127A; 131ABC; 132AB; 135BC; 136A; 139A; 141A
070	Red	9-11AB7-8	41A; 42AB; 43AB; 44ABC; 45ABCD; 46BCD; 47A; 50A
080	Purple	10EF7-8; 11-14DEF7-8	59AB; 60AB; 61AB; 64AB; 71AB; 72AB; 77A; 78A; 80A; 81A;
081	Light purple	10-12BCD4-5; 13-14ABC4-5	66B; 67BC; 68AB; 70B; 72BC; 73A; 74B; 75A; 77BC; 78CD;
082	Reddish to light purple	10-14AB4-6;	57BCD; 58CD; 63C; 66C; 67BCD; 72CD; 74CD;
083	Purple shade	10-14A2-3	65A; 63D; 68CD; 69A;
100	Black	F1	202A

ANNEX III. Cross-references to other documentation systems and their recording stages

The table below summarizes the cross-references of descriptors to other systems and their recording stage, as follows:

Other systems

Key: "*" marks characters included in the minimal subset of UPOV (2004) Technical Guidelines for rice

UPOV Number: descriptor number in UPOV (2004). A negative number is given (in parentheses) where the descriptor states in UPOV differ significantly from those presented here

IBPGR-IRRI: descriptor number in the 1st edition (IBPGR-IRRI 1980). Two or more descriptors share the same original number in cases where an original compound descriptor has been resolved into its components in the revised descriptors. For example, intensities of green, presence of anthocyanin and distribution of anthocyanin were combined into a single descriptor in the 1st edition, but are separated into different traits for this edition.

Stage of recording

The growth stage at which the descriptor is recorded under three systems; blank entries indicate the descriptor is not recorded

UPOV = stage recommended by UPOV

IRRI Cultivated = stage recorded for routine characterisation of cultivated species in the International Rice Genebank at IRRI

IRRI Wild = stage recorded for routine characterisation of wild species in the International Rice Genebank at IRRI

Trait	Other systems			Stage of recording		
	UPOV key	UPOV Number	IBPGR-IRRI	UPOV	IRRI Cultivated	IRRI Wild
7.1	Population uniformity					
Growth cycle traits						
7.2.1	Effective seeding date					
7.2.2	First heading					
7.2.2.1	Days from seeding to first heading date					Heading
7.2.2.2	First heading date					
7.2.3	Main heading					
7.2.3.1	Days to main heading	*	(19)	20	Heading	Heading
7.2.3.2	Main heading date					
7.2.4.1	Days to maturity		44	50	Near maturity	Maturity
7.2.4.2	Maturity date					
7.2.5	Life cycle					Harvest
Vegetative data						
7.3.1	Coleoptile: anthocyanin colouration		1		First leaf emerged	
7.3.2	Seedling: height			7		5 leaf stage
7.3.3	Basal leaf sheath: colour		2	12	Late vegetative	Vegetative
7.3.4	Leaf sheath: anthocyanin colouration		6-7		Late vegetative	
7.3.5	Leaf blade: intensity of green colour		3	11	Late vegetative	Late vegetative
7.3.6	Leaf blade: presence of anthocyanin colouration		4	11	Late vegetative	Late vegetative
7.3.7	Leaf blade: distribution of anthocyanin colouration		5	11	Late vegetative	Late vegetative
7.3.8	Leaf blade: attitude			13		Late vegetative
7.3.9	Leaf blade: pubescence		8	10	Late vegetative	Late vegetative
7.3.10	Leaf margin: pubescence					Late vegetative

Trait	Other systems			Stage of recording			
	UPOV key	UPOV Number	IBPGR-IRRI	UPOV	IRRI Cultivated	IRRI Wild	
7.3.11	Auricle: colour	*	(9)	19	Late vegetative	Late vegetative	Late vegetative
7.3.12	Collar: colour		10	18	Late vegetative	Late vegetative	Late vegetative
7.3.13	Ligule: length			15		After anthesis	After anthesis
7.3.14	Ligule: shape		11	17	Late vegetative	Late vegetative	After anthesis
7.3.15	Ligule: margin shape						After anthesis
7.3.16	Ligule: pubescence						After anthesis
7.3.17	Ligule: colour		12	16	Late vegetative	Late vegetative	Late vegetative
7.3.18	Leaf blade: length		13	8	Late vegetative	Early grain filling	7 days after anthesis
7.3.19	Leaf blade: width		14	9	Late vegetative	Early grain filling	7 days after anthesis
7.3.20	2nd leaf blade: length						7 days after anthesis
7.3.21	2nd leaf blade: width						7 days after anthesis
7.3.22	Culm: habit		17	23	Late vegetative	After flowering	After flowering
7.3.23	Culm: kneeling ability		18		Late vegetative		
7.3.24	Flag leaf: attitude (early observation)	*	15		Anthesis	Anthesis	7 days after anthesis
7.3.25	Culm: length	*	26	21	Early grain filling	Flowering - maturity	7 days after anthesis
7.3.26	Culm: number			22		After flowering	
7.3.27	Culm: diameter at basal internode		25	24	Early grain filling	Flowering or late reproductive stage	Late reproductive stage
7.3.28	Culm: anthocyanin colouration on the nodes	*	27-28		Early grain filling	After flowering - near maturity	After flowering - near maturity
7.3.29	Culm: underlying node colour					After flowering - near maturity	After flowering - near maturity

Trait	Other systems			Stage of recording			
	UPOV key	UPOV Number	IBPGR-IRRI	UPOV	IRRI Cultivated	IRRI Wild	
7.4.12	Awn thickness					After anthesis	
7.4.13	Panicle: arrangement of primary branches					After anthesis	
7.4.14	Panicle: number of basal primary branches					After anthesis	
7.4.15	Panicle: distance from base to lowest branch					Full panicle exertion	
7.4.16	Panicle: texture of main axis					Full panicle exertion	
7.4.17	Panicle: number per plant		31	Early grain filling	Early ripening		
7.4.18	Panicle: length (early observation)	*	30	27	Early grain filling-Near maturity	Late flowering to early maturity	7 days after anthesis
7.4.19	Panicle: attitude of main axis	*	39	31	Near maturity	Near maturity	Near maturity
7.4.20	Panicle: attitude of branches	*	42	28	Near maturity	Near maturity	7 days after anthesis
7.4.21	Panicle: secondary branching		40-41	29	Near maturity	Near maturity	Near maturity
7.4.22	Panicle: exertion		43	30	Near maturity	Near maturity	Near maturity
7.4.23	Panicle: shattering			32		Maturity or harvest	Maturity or harvest
Traits recorded after harvest							
7.5.1	Panicle: length (late observation)					After harvest	
7.5.2	Panicle: threshability			33		After harvest	
7.5.3	Awns: colour (late observation)		38	35	Near maturity		
7.5.4	Lemma and palea: pubescence	*	(36)	39	Anthesis-Mid grain filling	After harvest	
7.5.5	Lemma and palea: colour (late observation)		46-47	38		After harvest	After harvest

62 Rice

Trait	Other systems			Stage of recording		
	UPOV key	UPOV Number	IBPGR-IRRI	UPOV	IRRI Cultivated	IRRI Wild
7.5.6	Lemma: anthocyanin in keel (late observation)	48	38	After harvest		
7.5.7	Lemma: anthocyanin of area below apiculus (late observation)	49	38	After harvest		
7.5.8	Lemma: colour of apiculus: (late observation)	50	36	After harvest	After harvest	
7.5.9	Lemma: shape of apiculus				After harvest	
7.5.10	Sterile lemma: length	51	41	After harvest	After harvest	After harvest
7.5.11	Longer sterile lemma: length				After harvest	After harvest
7.5.12	Sterile lemma: shape					After harvest
7.5.13	Sterile lemma: colour	52	40	After harvest	Near maturity	
7.5.14	Spikelet: fertility		42		After harvest	At harvest
7.5.15	Grain: length	54	44	After harvest	After harvest	After harvest
7.5.16	Grain: width	55	45	After harvest	After harvest	After harvest
7.5.17	Grain: thickness					After harvest
7.5.18	Grain: 100-grain weight	(53)	43	After harvest	After harvest	
7.5.19	Grain: 10-grain weight					After harvest
7.5.20	Caryopsis: length	*	58	After harvest		
7.5.21	Caryopsis: width		59	After harvest		

Trait	Other systems			Stage of recording		
	UPOV key	UPOV Number	IBPGR-IRRI	UPOV	IRRI Cultivated	IRRI Wild
7.5.22	Caryopsis: shape	*	60		After harvest	
7.5.23	Caryopsis: pericarp colour	*	61	46	After harvest	After harvest
7.5.24	Endosperm type		62	47	After harvest	After harvest
Grain cooking and quality traits						
8.1.1	Lemma: phenol reaction		56-57		After harvest	
8.1.2	Caryopsis scent	*	65	48	After harvest	
8.1.3	Endosperm amylose content		63		After harvest	
8.1.4	Gelatinization temperature by alkali digestion		64		After harvest	
8.1.5	Gelatinization temperature DSC					
8.1.6	Gel consistency					
8.1.7	Brown rice protein content					
8.1.8	Lysine content					
8.1.9	Parboiling loss					
8.1.10	Elongation ratio					



IPGRI and INIBAP
operate under the name
Bioversity International

Supported by the CGIAR

ISBN-13: 978-92-9043-716-1
ISBN-10: 92-9043-716-2