

Descriptors for Wheat & Aegilops



IBPGR



IS/GR

AGPE: IBPGR/77/20
March 1978

INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES
and
INFORMATION SCIENCES/GENETIC RESOURCES PROGRAM

A Minimum List

IBPGR SECRETARIAT
Rome, 1978

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Crop Ecology and Genetic Resources Unit
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
Via delle Terme di Caracalla, Rome 00100, Italy

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REPORT

1. A Working Group on wheat descriptors appointed by the IBPGR met at the Information Sciences/Genetic Resources (IS/GR) Program at the University of Colorado, at Boulder, Co. USA, from 26 - 29 April 1977. The members of the Working Group were: Dr. V.F. Dorofeev, Leningrad, USSR; Dr. V. Johnson, Lincoln, Nebraska, USA; Mr. L. Seidewitz, Braunschweig-Volkenrode, Federal Republic of Germany; Dr. M. Tanaka, Kyoto, Japan. Drs. J.E. April, G.R. McArthur and K. Rawal of the IS/GR Program also participated. The Agenda of the Working Group meeting is shown in Appendix I.

2. The objectives for the Working Group were outlined in the report to the IBPGR of the first meeting of the IBPGR Advisory Committee on Wheat Genetic Resources (1976). These were as follows:

*“In order to draw up the minimum descriptors for wheat (including *Aegilops*), the Committee recommends that the Board approves the convening of a small Working Group which should produce a minimum list of taxonomic, morphological, physiological, resistance, and quality characteristics. In addition, it should produce an inventory of descriptors for evaluation of wheat germplasm currently used in various gene centres and collate a minimum list. The lists should then be agreed upon by the Wheat Advisory Committee”.*

“The Committee proposes to establish a pilot scheme and recommends that material from existing collections in the three major centres designated (USSR, USA, Italy) be given to approximately 10 to 15 institutes in all parts of the world for preliminary evaluation using the minimum descriptors (and standard descriptor states) to be drawn up by the Working Group on single row observations.”

3. After considerable deliberations using summaries of existing wheat data banks held at IS/GR, a Wheat Descriptor Classification Scheme (see Appendix II) and a prototype Wheat Glossary (including the names and definitions of descriptors in actual use) the Working Group selected a list of minimum descriptors for wheat genetic resources.

4. The recommended list of minimum descriptors along with the definitions of each descriptor and the descriptor states is shown in Appendix III.

5. Six recommendations pertinent to the general and operational aspects of new and backlog data on wheat genetic resources were drawn up to satisfactorily execute the functions of data acquisition:

(a) The Working Group recommends that the IBPGR Advisory Committee on Wheat Genetic Resources provides direction in requesting financial support for centres requiring assistance in up-dating and organizing data on wheat genetic resources for the list of minimum descriptors.

(b) The Working Group urges that systematic investigations be carried out to understand various technical aspects of communication, data acquisition, data analysis and technical assistance, software development and transfer, education and training, and research in order to accomplish an effective information system for the international genetic resources community.

(c) As regards backlog data, the Working Group recommends that the curators and organizations in possession of data on wheat genetic resources throughout the world cooperate by forwarding their data to the IS/GR Program at Boulder, Colorado, USA. Such

cooperation is expected to enhance the availability of information thereby promoting greater access to wheat genetic resources by the community.

(d) As regards new data, the Working Group expresses its concern for obtaining reliable data and recommends that the IS/GR Program become cooperatively involved from the beginning of an international evaluation programme for wheat genetic resources in the areas of data acquisition, data analysis, and data communication.

(e) The Working Group urges that attention be given by the wheat community to identify an organization to coordinate new data collection activities of an international evaluation programme for wheat genetic resources with a view to obtaining reliable and transferable data on the minimum descriptors. The Working Group further urges that the IBPGR Advisory Committee on Wheat Genetic Resources provide strong direction to the designated group in order to accomplish this task and that financial support be provided to carry out certain phases of data collection in the international evaluation programme.

(f) For the purposes of international exchange of wheat resources, the Working Group assumes that reported data reflect genetic resources that are available for distribution in viable condition.

6. The Working Group agrees completely with the recommendation of the IBPGR Advisory Committee on Wheat Genetic Resources (specifically with reference to paragraph 28 of the Advisory Committee First Report, 1976). In addition, the Working Group recommends that for the exchange of information on wheat genetic resources the format requirements (Appendix V) agreed upon at the Leningrad Wheat Symposium be accepted. In order to use the suggested lists of minimum descriptors for wheat genetic resources, the following recommendations were agreed:

(a) It is recommended that for international communication of data on wheat genetic resources in accordance with the list of minimum descriptors, at a minimum the following languages should be used: English, French, German, Japanese, Russian and Spanish.

(b) Descriptor measurements must be reported in metric units (e.g., g, cm, etc.).

(c) The units of measurements must be specified along with the data.

(d) In cases where the use of a grading scale is required, the Working Group strongly recommends the use of a 1-9 scale, where 1 denotes the weakest expression of a characteristic and 9 the strongest.

(e) The Working Group recommends that the list of minimum descriptors be used for both new evaluations as well as backlog data.

(f) The Working Group recognizes the need to incorporate data on certain descriptors not included in the suggested list of minimum descriptors. These descriptors are to be considered optional. The relevant notes on this set of optional descriptors can be found in Appendix IV.

7. The participants recognized the need to initiate an international evaluation programme for wheat genetic resources. The programme should be undertaken on a pilot basis as outlined in paragraph 8 below. As regards this programme, the Working Group agreed upon the following:

(a) It is stressed that an international evaluation programme be considered an initial phase of a long-term and continuing effort to obtain data on wheat genetic resources in a systematic fashion through international cooperation.

(b) It is recommended that the IS/GR Program be actively involved in the data-related aspects of this evaluation programme. The respective co-operators in the programme will contribute their data to the IS/GR Program which will subsequently make the data available to the entire wheat genetic resources community.

(c) It is recommended that a group of check varieties representing currently grown wheat from major wheat producing areas of the world be designated and used at evaluation sites as points of reference for collecting data according to the suggested list of minimum descriptors.

(d) It is recommended that site, year, name and address of evaluators must always be specified whenever the data on evaluations of wheat genetic resources are reported.

(e) Since the dates of planting and dates of harvest vary from location to location, for winter and spring wheats, the Working Group recommends that for evaluation purposes, the practices of planting and harvesting common to a given locality should be followed.

(f) It is recommended that the evaluation of the same accessions be carried on for two years if the evaluator deems it necessary.

(g) The Working Group recognizes that for evaluation purposes *Aegilops* and related species of wheat be considered as special cases. However, at the present time the list of minimum descriptors for wheat genetic resources appears applicable to *Aegilops* and related species of wheat. The Working Group empowers the participants from the USSR and Japan to add more descriptors to this minimum descriptor list or to modify them in the case of *Aegilops* and related species if necessary.

(h) It is recommended that the participants from the USSR and Japan be responsible for the evaluation of *Aegilops* and related species of wheat in their countries.

8. As regards an international evaluation programme for wheat genetic resources, the Working Group agreed upon the following plan of action for this evaluation effort.

(a) A total of 600 winter wheat accessions will be provided for the international evaluation programme, 200 accessions from the USSR, 200 from the USA and 200 from the Federal Republic of Germany.

(b) A total of 600 spring wheat accessions will be provided for the international evaluation programme. 200 accessions from the USSR, 200 from the USA and 200 from Bari, Italy.

(c) The Working Group agrees that additional accessions from other institutions and countries may be included in the evaluation programme in addition to the above-mentioned accessions for winter and spring wheat.

(d) The Working Group recommends that the planting of accessions for the evaluation of winter and spring wheat be accomplished using either 2m long, single row plots or 1m long two-row plots without any replication.

(e) The Working Group recommends that the following seven sites be considered for the international evaluation programme; for winter wheat, the Working Group agrees upon three sites; Krasnodar, USSR, an unspecified site in the USA and an unspecified site in the Federal Republic of Germany. For Spring wheat evaluations, the Working Group agrees upon four sites; Kinnel (Volga), the USSR, a site in the USA, one site to be determined in each of the following countries: USA, Argentina and Australia.

(f) The Working Group recommends that an international evaluation programme should commence by 1978.

(g) The Working Group recommends that the evaluation data be collected on the same sets of accessions at all the sites of evaluation respectively for spring and winter wheats.

9. In accordance with paragraphs 7(g) and 7(h) above, the Working Group concurs with the plan of action for evaluation of *Aegilops* and related species of wheat proposed by Dr.

Dorofeev and Dr. Tanaka. The details of the plan of action for this evaluation are as follows:

(a) The evaluation for *Aegilops* and related species of wheat will be conducted in Japan and the USSR; specific sites for evaluation within these countries to be subsequently determined.

(b) As in the case of the evaluation for wheat, this evaluation programme will also be considered preliminary; in the future to be extended to all available and viable accessions of *Aegilops* and related species of wheat.

(c) As regards the accessions to be evaluated in this initial programme, the N.I. Vavilov Institute will provide the following accessions of *Triticum*:

<u>Species</u>	<u>No. of Accessions</u>
1. <i>Triticum boeoticum</i>	6
2. <i>T. urartu</i>	3
3. <i>T. monococcum</i>	10
4. <i>T. sinskaya</i>	1
5. <i>T. araraticum</i>	5
6. <i>T. dicoccoides</i>	10
7. <i>T. timopheevi</i>	21
8. <i>T. militinae</i>	1
9. <i>T. dicoccum</i>	25
10. <i>T. georgicum</i>	3
11. <i>T. zhukovskyi</i>	1
12. <i>T. macha</i>	3
13. <i>T. persicum</i>	100
14. <i>T. spelta</i>	<u>10</u>
	TOTAL: <u>199</u>

(d) As regards the accessions to be evaluated in this initial programme, the Plant Germplasm Institute, Faculty of Agriculture, Kyoto University, Japan, will provide the following accessions belonging to *Aegilops* and *Triticum*:

<u>Species</u>	<u>No. of Accessions</u>
1. <i>Aegilops longissima</i>	10
2. <i>A. speltoides</i>	140
3. <i>A. squarrosa</i>	250
4. <i>Triticum boeoticum</i>	200
5. <i>T. urartu</i>	15
6. <i>T. araraticum</i>	350
7. <i>T. dicoccoides</i>	<u>40</u>
	TOTAL: <u>1 005</u>

(e) The same sets of accessions will be evaluated at both sites according to the list of minimum descriptors (see also 7(g)).

(f) The recommendation for the evaluation of wheat genetic resources as specified in paragraph 7(b) (above) will also apply to this evaluation programme.

APPENDIX I - Agenda

Welcome and Introduction

Presentation of Committee Guidelines

Review of Agenda

Wheat Community Status on Documentation

Background Review (Passport and Collection Descriptors)

Wheat Data Information and Technical Services

Wheat Descriptor Classification, Wheat Glossary and Wheat Analysis

User Community Requirements and Recommendations

USSR

Japan

Other European Countries

USA

Other Countries

Participant Discussion on Minimum Wheat and *Aegilops* descriptor lists

Suggested procedures for selecting list

Selection of criteria, determination of descriptors and definitions

Participant Discussion of descriptor selection for Evaluation of Wheat Germplasm

Methods of Analysis

Where? When? How? Who?

Participant Summary and Agreement on:

Objectives

Descriptor lists

Evaluation Recommendations

Drafting of formal recommendations

IS/GR expanded discussion

Wheat Data Services

Diversity and Duplicate identification programme

APPENDIX II - Wheat Descriptor Classification Scheme developed at IS/GR at the Levels of Data Type, Data Sub-Type, and Common Descriptor Name

COLLECTION DATA

1. Collector Identifier

- A. Collection Sponsor
- B. Collecting Organization
- C. Collector/Team Name
- D. Collector Initial
- E. Additional Collector Identifier Data

2. Collecting Nomenclature

- A. Accession Number
- B. Crop Name
- C. Genus
- D. Species
- E. Sub-species
- F. Group
- G. Common/Local Name
- H. Pedigree
- I. Additional Collection Nomenclature Data

3. Locality of Collection

- A. Country of Origin
- B. Geographic Area
- C. Locality Type
- D. Site of Collection
- E. Latitude
- F. Longitude
- G. Additional Locality of Collection Data

4. Environment of Collection

- A. Altitude
- B. Habitat
- C. Precipitation
- D. Temperature
- E. Additional Environment of Collection Data

5. Donor Identifier

- A. Donor Name
- B. Donor Number
- C. Donor Source
- D. Additional Donor Identifier Data

6. Germplasm Deposit Point

- A. Primary Deposit Point
- B. Secondary Deposit Point
- C. Year of Primary Deposit
- D. Year of Secondary Deposit
- E. Additional Germplasm Deposit Point Data

7. Collection Identifier

- A. Collection Code
- B. Collection Number
- C. Date of Collection
- D. Entry
- E. Form Collected
- F. Additional Collection Identifier Data

8. Additional Collection Data

MAINTENANCE DATA

1. Storage Identifier

- A. Accession Number
- B. Bank
- C. Additional Storage Identifier Data

2. Location in Storage

- A. Building
- B. Floor
- C. Room
- D. Row
- E. Rack
- F. Shelf
- G. Tray
- H. Box/Can/Envelope Number
- I. Additional Location in Storage Data

3. Accession Viability

- A. Site of Germination
- B. Year of Germination
- C. Initial Germination
- D. Current Germination
- E. Seed Longevity
- F. Additional Accession Viability Data

4. Accession Transaction

- A. Supplier
- B. Recipient
- C. Present Quantity
- D. Additional Accession Transaction Data

5. Accession Increase

- A. Site of Increase
- B. Year of Increase
- C. Planting Date
- D. Harvest Date
- E. Quantity Harvested
- F. Additional Accession Increase Data

6. Additional Maintenance Data

AGRONOMIC EVALUATION DATA

1. Agronomic Evaluation Identifier
 - A. Agronomic Evaluation Site
 - B. Agronomic Evaluation Year
 - C. Evaluator Name/Address
 - D. Planting Date
 - E. Harvest Date
 - F. Additional Agronomic Evaluation Identifier Data

2. Maturity
 - A. Days to Flower
 - B. Days to Harvest
 - C. Additional Maturity Data

3. Growth Habit
 - A. Growth Habit Class
 - B. Lodging Susceptibility
 - C. Number of Leaves Below Ear
 - D. Number of Tillers
 - E. Plant Height
 - F. Plant Vigour
 - G. Additional Growth Habit Data

4. Yield Components
 - A. Ear Size
 - B. Kernel Weight
 - C. Flag Leaf
 - D. Straw Yield
 - E. Chaff Yield
 - F. Additional Yield Component Data

5. Agronomic Quality
 - A. Kernel Hardness
 - B. Kernel Type
 - C. Percent of Germ
 - D. Additional Agronomic Quality Data

6. Environmental Adaptability
 - A. Winter Hardiness
 - B. Drought Tolerance
 - C. Additional Environmental Adaptability Data

7. Additional Agronomic Evaluation Data

MORPHOLOGICAL EVALUATION DATA

1. Morphological Evaluation Identifier
 - A. Morphological Evaluation Site
 - B. Morphological Evaluation Year
 - C. Evaluator Name/Address

2. Stem

- A. Number of Nodes per Plant
- B. Stem Diameter
- C. Straw Strength
- D. Stem Colour
- E. Additional Stem Data

3. Leaf

- A. Leaf Area Index
- B. Leaf Blade
- C. Leaf Sheath
- D. Auricles
- E. Additional Leaf Data

4. Inflorescence

- A. Spike
- B. Rachis
- C. Spikelet
- D. Glume
- E. Awn
- F. Additional Inflorescence Data

5. Seed

- A. Kernel Length
- B. Kernel Colour
- C. Embryo Size
- D. Additional Seed Data

6. Cytological

- A. Chromosome Number
- B. Additional Cytological Data

7. Additional Morphological Evaluation Data

PEST RESISTANCE EVALUATION DATA

1. Pest Resistance Evaluation Identifier

- A. Pest Resistance Evaluation Site
- B. Pest Resistance Evaluation Year
- C. Evaluator Name/Address

2. Viral Resistance

- A. Bastic Yellow Dwarf Virus
- B. Barley Yellow Dwarf Virus
- C. Wheat Streak (Striate) Mosaic Virus
- D. Soil-borne Mosaic Virus
- E. Additional Viral Resistance Data

3. Bacterial Resistance

4. Fungal Resistance

- A. Stripe Rust
- B. Leaf Rust

- C. Stem Rust
- D. Bunt/Smut
- E. Alternaria
- F. Mildews
- G. Root Rots
- H. Septoria
- I. Additional Fungal Resistance Data

5. Nematode Resistance

- A. Root Cyst Nematode
- B. Additional Nematode Resistance Data

6. Insect Resistance

- A. Hessian Fly
- B. Greenbug
- C. Stem Sawfly
- D. Cereal Leaf Beetle
- E. Additional Insect Resistance Data

7. Additional Pest Resistance Evaluation

BIOCHEMICAL EVALUATION DATA

1. Biochemical Evaluation Identifier

- A. Biochemical Evaluation Site
- B. Biochemical Evaluation Year
- C. Evaluator Name/Address

2. Carbohydrate Content

- A. Flour Extraction
- B. Starch Content
- C. Amylose Content
- D. Amylopectin Content
- E. Additional Carbohydrate Content Data

3. Lipid Content

- A. Total of Content
- B. Linoleic Acid Content
- C. Oleic Acid
- D. Palmitic Acid Content
- E. Additional Lipid Content Data

4. Protein Content

- A. Total Protein Content
- B. Additional Protein Content Data

5. Amino Acid Profile

- A. Lysine Content
- B. Additional Amino Acid Profile Data

6. Additional Biochemical Evaluation Data

END USE QUALITY DATA

Data Sub-types (in progress)

Common Descriptor Names (in progress)

APPENDIX III - The List of Suggested Minimum Descriptors and their Definitions for Wheat Genetic Resources

1. Collecting Organization:

Name of the institution responsible for collecting a particular germplasm accession. The collector will usually be a member of this organization.

2. Accession Number:

A unique alphanumeric or numeric identifier for a given germplasm collection.

3. Crop Name:

Informal generic term given to an agricultural product (e.g. wheat).

4. Genus:

Formal name for a main sub-division of a Family which includes one or more species.

5. Species:

A sub-division of a genus represented by a name or code.

6. Common/Local Name:

Name given locally to a particular germplasm accession by the farmers who grow it, including the names of varieties released through improvement programmes.

7. Country of Origin:

Full name or an abbreviation for the country in which a particular germplasm accession was collected.

*8. Geographic Area:

Name or code representing the political or administrative sub-division of the country in which a particular germplasm accession was collected.

*9. Latitude:

Latitude in degrees at which a particular germplasm accession was collected. To be indicated by N (North) or S (South).

*10. Longitude:

Longitude in degrees at which a particular germplasm accession was collected. To be indicated by E (East) or W (West).

11. Altitude in Metres

Elevation above sea level at which a particular germplasm accession was collected.

12. Donor Name:

Name of the person or institution responsible for donating germplasm to a collector.

13. Donor Number:

Number assigned to an accession by the donor.

14. Location in Primary Storage:

Name and address of the institution at which a germplasm accession was first deposited for preservation.

15. Year of Primary Storage:

Year in which a germplasm accession was deposited at the location for primary storage for preservation.

16. Days to Flower:

Self-explanatory. Usually counted as number of days from 1 January (inclusive), when 50 percent of the plants in a planting of an accession are flowering.

17. Growth Habit Class:

In wheat referring to Winter or Spring types, coded W (Winter) or S (Spring).

18. Plant Height in cm.

Height of the wheat plant at maturity, excluding awns.

19. Kernel Texture

Code representing the relative hardness of a kernel. Expressed from 1 to 9 with 1 = very soft or floury, 9 = very hard or vitreous.

20. Kernel Plumpness:

Visual measure of wheat kernel plumpness. Coded from 1 to 9 with, 1 = shrivelled, 9 = plump.

21. Winter Hardiness:

Tolerance of a wheat accession to withstand cold stress. Measured on loss of plants in a planting of an accession. Coded from 1 to 9 with, 1 = very susceptible, 9 = very resistant.

22. Drought Resistance:

Tolerance of a wheat accession to withstand drought stress. Coded from 1 to 9. with, 1 = very susceptible, 9 = very resistant.

23. Cold Resistance:

Measure of damage caused by cold to aerial portions of plants. Not associated with loss of plants in a planting of an accession. Coded from 1 to 9 with, 1 = very susceptible, 9 = very resistant.

24. Sprouting Tendency:

Tendency of kernels to sprout when in the spike. Measured on a scale of 1 to 9 with, 1 = very low, 9 = high.

25. Stem Thickness:

A visual measure of stem thickness. Measured on a scale of 1 to 9 with, 1 = very thin, 9 = very thick.

26. Spike Density:

A visual measure of density of a wheat spike measured on a 1 to 9 scale. Coded, 1 = very lax, 9 = very dense (e.g. square head). Where club wheats are encountered it should be so indicated.

27. Number of Spikelets per Spike:

Total number of spikelets on a spike; an average of five spikes.

28. Number of Kernels per Spikelet:

Count of kernels from a known number of spikelets obtained from the central portion of the spike; an average of five spikes.

29. Awedness:

Observation on presence or absence of awns. Measured as 0 = absent, + = ungraded presence.

30. Kernel Colour:

Colour of a wheat seed. Coded, 1 = white, 2 = red, 3 = purple, 4 = brown, 5 = green, 6 = other.

31. Total Protein Content:

A measure of the total protein contained in kernels of a wheat accession. Measured as percent dry weight (seed moisture equal to or less than 12 percent). Indicate the conversion factors used as either $N \times 6.25$ or $N \times 5.6$

32. Weight of grain per unit area in grammes:

Self-explanatory.

33. Lysine/Protein Ratio:

Percent lysine per unit of protein (absolute).

* Either geographic area or precise latitude and longitude are to be selected

APPENDIX IV - Notes on Other Descriptors

After considerable discussion on various descriptors, the Working Group agreed that certain ones, although very important, are largely dependent upon environmental factors as well as the expertise of an evaluator. Therefore, standardization of descriptor terminology and descriptor states for these types of descriptors is difficult. The following is the list of other descriptors along with relevant notes: *

A. Optional Descriptors

1. Lodging Susceptibility
2. Number of Tillers per Plant
3. Plant Vigour
4. Straw Strength
5. Glume Hairiness
6. Furrow Depth

B. Pest Resistance Descriptors

Since there are location-specific races and biotypes of disease-causing organisms, and since the disease reactions of the host plant is growth-stage specific and dependent upon the environment, the Working Group feels that Pest Resistance Descriptors cannot be made part of the list of minimum descriptors. However, data on these descriptors are essential for location-specific improvement programmes. Therefore, the Working Group recommends that data on these types of descriptors be collected by competent field scientists, well aware of the variation in pathogenicity of disease-causing organisms.

* For an initial set of these descriptor definitions, and the standards to be used in evaluation, IS/GR should be consulted.

APPENDIX V - Procedures for Data Transmission adopted at the 1975 IBPGR Symposium on Wheat Genetic Resources

Data can be transmitted in machine-readable or non-machine-readable form. The following is proposed:

If machine-readable:

(a) 80 column standard cards IBM punch code equivalent or high quality magnetic tape should be used. The punch character set codes should be indicated (a copy made and sent with the data).

(b) Magnetic tape should be 9-track IBM compatible, external BCD (Note: punch conversion by the sender if tape, by the receiver if on punch cards), 800 BPI, 80 character records, not labelled with separate files for data and descriptive information. The tape should be accompanied by a memorandum stating tape serial number, place of origin, computer used, job control language used in processing, number and names of files contained. A listing of the data and the recording template should accompany the tape or cards.

If non-machine-readable:

Either columnar pads (80 or 120 column) or photocopies with field definitions used on first sheet of all original records should be sent, accompanied by the recording definitions. Letters should be crossed, not numerals.

Transmission should be by mail, diplomatic or FAO pouch. Data should be receipted immediately. Assistance should be provided from GR/CIDS team (IS/GR) for planning this aspect, if required.