DEVELOPMENT OF A DESCRIPTIVE LANGUAGE FOR GROUNDNUT (Arachis hypogaea)

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Foreword

The reasons for developing a common descriptive language for groundnuts which may be used in an international information system are the same as for other crops. Some of these reasons are: (i) lack of compatibility in data received from various research centers, (ii) difficulty in handling such varied data by the curator or scientist involved in genetic resources work, (iii) problems in distinguishing strains useful for breeding programs when information available is incomplete or ambiguous, (iv) recording characteristics of little or no utility to the user community, and (v) standardizing the documentation of data. Apart from these, the assembling of a world groundnut collection at ICRISAT center calls for an efficient way of exchanging information internationally so that the scientific community can make effective use of this material.

In consideration of these points, it was felt that there is an urgent need to develop a uniform descriptive language which will include all possible diagnostic characters for groundnuts (descriptors), descriptor definitions, descriptive states, and coding dictionaries. This could include the maximum and minimum descriptors for groundnuts. To develop such a language, the cooperation of the international groundnut research community is needed. In the next few pages, in collaboration with the Information Systems Genetic Resources Program (IS/GR), Colorado University, Boulder, USA, we list the suggested descriptors with definitions and states, some of which are currently in use at ICRISAT, along with a few descriptors used by the U.S. Department of Agriculture. We hope this may serve as a base from which to work towards a uniform descriptive language, based on comments and suggestions of research workers in groundnuts. The enclosed list includes an introduction by IS/GR, developer of the descriptive system.

This may be treated as a questionnaire, and we wish to receive your comments and suggestions on the idea and the contents.

The initial list of descriptors was developed through discussions with Dr. A.H. Bunting, International Board for Plant Genetic Resources (IBPGR), and was expanded at IS/GR. The attempt is limited to cultivated groundnut only. A separate set of descriptors may be needed for wild *Arachis* sp.

INTRODUCTION TO GROUNDNUT

DESCRIPTOR CLASSIFICATION AND DESCRIPTOR DEFINITIONS

A listing of the groundnut descriptors currently in use would be a redundant and unwieldy document, with a great number of functionally equivalent descriptors, differing in name or method of measurement. For a groundnut data base to meet the requirement of ease of reference, some technique for recognizing functional equivalence and redundancy is needed. IS/GR has found it necessary to classify other crops (i.e. wheat, maize) descriptors in a convenient way. This descriptor classification scheme is presented below.

The classification scheme was developed to accommodate the needs and interests of crop workers. An administrator who must decide where to use limited resources most efficiently in collecting new groundnut accessions is not, for example, likely to be interested in the same data as a plant breeder. Morphologists and agronomists overlap somewhat in their interests, but are likely to be more concerned with different sets of descriptors. The classification scheme presented here was developed to accommodate these needs and to manage diversity while also recognizing synonomy.

We hope you will view this classification scheme as provisional and dynamic. Feedback from the groundnut genetic resources community is needed to evaluate its usefulness and to pinpoint discrepancies. As new types of data are collected, new categories may be needed at all levels. Categories also may be revised to better reflect the functional and operational needs for data. Some data types have not as yet been subdivided into meaningful classes because of a lack of descriptors in those data types. We have attempted to anticipate future data needs, but we need more input from the groundnut genetic resources community in terms of both descriptors and data if this scheme is to prove useful as a starting point for a comprehensive data-base model for groundnuts.

The classification scheme recognizes four levels of descriptor classification, schematically represented as follows:

Data type
Data subtype
Common descriptor name
Actual descriptor

Please note that each level of the classification scheme is given a provisional opening for additional data. The scheme is therefore as dynamic and flexible as required by the u:

The highest level, the data type, is a major disciplinary interest, a functional need for data in genetic resources work. Ten data types ar- recognized:

1. Collection data
2. Maintenance data
3. Agronomic evaluation data
4. Morphological evaluation data
5. Pest-resistance evaluation data
6. Biochemical data
7. Breeding data
8. End-use quality data
9. Socioeconomic data
10. Additional data

The second level of the classification hierarchy is the data subtype. A data subtype represents a specific operational need for data within a given genetic resources function. As an example, data subtypes for collection data are:

1. Collection identifier
2. Collector identifier
3. Collection nomenclature
4. Collection locality
5. Collection environment
6. Donor identifier
7. Additional collection data

The third level within the scheme is the common description name, a generalized name for a synonomous or closely related group of descriptors actually in use. The common descriptor name is a functional class of observations. For example, the data subtype "Collection locality" includes the common descriptor names listed below:

1. Country
2. State
3. Locality
4. Latitude
5. Longitude
6. Race

The lowest level in the classification scheme is the actual descriptor name as it appears in one or more groundnut data banks. For example, the common descriptor name "country" might include the following descriptor names:

1. Codigo pais
2. Country of origin
3. Origem
4. Origem 2
5. Origen
6. Pais
7. Pais de origen
8. Pais orig

The concept of the common descriptor name is central to further development of a descriptive language for genetic resources communication. The effectiveness of the lists of common descriptor names is heavily dependent, however, upon the rigor with which it is applied to the definition of these terms. Definitions for use in this context must be completely free of ambiguity. This lack of ambiguity can be achieved only when all descriptors within a given common descriptor category have been clearly and precisely defined by the persons or centers collecting the data. Clearly, a need exists for rigorous definition of all descriptors currently in use.

HIERARCHICAL DESCRIPTOR LIST AND DEFINITIONS FOR GROUNDNUTS

Collection data
- Additional Collection Data
  - Remarks
    - ICRISAT
      - Additional textual information provided by the collector and not covered elsewhere
- Usage
  - ICRISAT
    - Whether used for confectionery-culinary or oil purposes
- Collection environment
  - Altitude
    - ICRISAT
      - Elevation above sea level recorded in meters
  - Irrigation
    - ICRISAT
      - Presence or absence of irrigation, recorded as + or -
  - Soil type
    - ICRISAT
      - given to soil type by the collector
- Collection identifiers
  - Breeding type
    - ICRISAT
      - Whether experimental type results from selection-mutation or hybridization
  - Breeding year
    - ICRISAT
      - Year in which the experimental accession was developed
  - Collection date
    - ICRISAT
      - Coded as year, month, day in numerals
  - Collector number
    - ICRISAT
      - Number given to the accession by the collector in the field
  - Sample source
    - ICRISAT
      - Whether sample was collected from a field, market, or institution

Sample type
ICRISAT
Whether sample is from authentic collection, experimental type, or wild species[1]

Collection locality
Country of Breeding
ICRISAT
Country where experimental station exists (if an experimental variety)

Country of origin
ICRISAT
Country where the accession was first collected

USDA
Country in which collection was originally collected Abbreviated

Cultivator
ICRISAT
Name of the person who was growing a particular accession when it was collected

Ethnic group
ICRISAT
Name of the tribe of people living in the area of collection

Experimental station
ICRISAT
Name of experimental station where accession was developed

Latitude
ICRISAT
Recorded in degrees and minutes South or North

Longitude
ICRISAT
Recorded in degrees and minutes East or West

Nearest village
ICRISAT
Name of nearest village or other permanent landmark

Province/State
ICRISAT
Administrative region immediately below the country level

[1]Descriptors for wild species are yet to be determined.

Collection nomenclature

Crop name

ICRISAT

Common name of the crop - i.e. Groundnut

Cultivar name

ICRISAT

Cultivar name given to the cultivated accession by the institution

Genus

ICRISAT

The genus to which the accession is assigned, i.e. *Arachis*

USDA

Name of genus to which the accession is assigned (entered as four-letter abbrev.)

Local name

ICRISAT

Vernacular name given to the accession by the people of the region

Pedigree

ICRISAT

Parental history - names or codes assigned by crop scientists to a particular accession

Species

ICRISAT

Species to which the accession is assigned

USDA

Species to which accession is assigned (entered as a six-letter abbrev.)

Variety

ICRISAT

Botanical variety name given to the accession

Collection identifiers

Collecting organization

ICRISAT

Name of the organization carrying out collection

Collection sponsor

ICRISAT

Name of organization sponsoring the collection

Collector name
ICRISAT
Name of collector or group leader

Donor:
ICRISAT
Name of the person or organization donating a particular accession

Maintenance Data
Accession identifiers
ICG Number
ICRISAT
Unique identifier assigned to groundnut accessions by ICRISAT

PI Number
USDA
Unique number given to the accession by USDA

Synonyms
ICRISAT
Numbers assigned to the accession by other sources

Agronomic Data
Kernel Characteristics
Dormancy
ICRISAT
Number of days dormancy

Dormancy-14
USDA
Percent dormant kernels tested by placing in germinator 14 days after digging

Dormancy Fresh
USDA
Percent dormant kernels tested by placing in germinator 2 days after digging

Kernels/Pod
USDA
1=One, 2=Two, 3=Three, 4=<Three, 5=Two and Three, 6=Three and Four

Kernels/Pod Maximum
ICRISAT
Actual count of kernels

Kernels/Pod Mean
ICRISAT
Mean number of kernels per pod

Kernels/Pod Minimum
ICRISAT
Actual count of kernels

Kernel color
ICRISAT
Recorded as variegated or nonvariegated

Kernel color primary[2]
ICRISAT
Pearl white, off white, dark tan, light tan, pale tan, red, purple, pink, yellow, other

Kernel color secondary (if variegated, minor colour)[2]
ICRISAT
Pearl white, off white, dark tan, light tan, pale tan, red, purple, pink, yellow, other.

Kernel number/unit volume
ICRISAT
Actual unit volume recorded (needs to be agreed upon)

Kernel shape
ICRISAT
Recorded as round, flat, protruded radicle end, flattened ends

Kernel size
ICRISAT
1=Very Small, 3=Small, 4=Medium Small, 5=Medium, 6=Medium Bold, 7=Bold, 9=Very Bold

USDA
1=Small(71-90/oz), 5=Medium(51-70/oz), 8=Large(36-50/oz), 9=Jumbo(20-35/oz)

Pod filling
ICRISAT
1=Very Good, 3=Good, 5=Fair, 7=Poor, 9=Very Poor

Shelling Percent
ICRISAT
Weight of mature kernels/total weight of sample

[2]Royal Horticultural Society Colour Charts may be used for grades.

USDA
Total kernel content based on a minimum pod sample of 200

Testa Color
USDA
Flesh, Pink, Red, Purple, Wine, Dark Purple, White, Variegated, other colors, or mixed

Unusual kernel shape
ICRISAT
Textual description of unusual kernel shapes

Yield/hectare
ICRISAT
Given as a mean

Yield/Plant
ICRISAT
Expressed as a mean

Yield/plot
ICRISAT
Given as a mean

100-kernel weight
ICRISAT
Weight in grams

MATURITY CHARACTERISTICS
Emergence time
ICRISAT
Number of days from planting to emergence

Flowering duration
ICRISAT
Number of days from opening of initial flower to closing of final flower

Flower initiation time (Days to First Flower)
ICRISAT
Days from planting--or emergence (must be decided)

Maturity
USDA
1=Early (>130 days), 5=Medium (131-140), 8=Late (141-145), 9=Very late (>146)

Maturity days (Days to Maturity)
ICRISAT
Mean number of days from planting to maturity

Days to 75 percent flowering
ICRISAT
Days from planting--or emergence (must be decided)

POD CHARACTERISTICS
Pod type
USDA
Spanish, Spanish/Valencia, Valencia/Spanish, Valencia, Virginia, Chinese, Mixed

Pod beak
ICRISAT
3=Slight, 5=Fair, 7=Prominent, 9=Highly prominent

Pod constriction
ICRISAT
1=None, 3=Slight, 5=Fair, 7=Deep, 9=Very deep

Pod reticulation
ICRISAT
3=Smooth, 5=Slightly ribbed, 7=Strongly ribbed, 9=Highly ribbed

Pod size
ICRISAT
1=Very small, 3=Small, 5=Medium, 7=Large, 9=Very large

Shell thickness
ICRISAT
3=Thin, 5=Medium, 7=Thick, 9=Very thick

Total Mature pods/plant
ICRISAT
Mean of ten plants

Total pods/plant
ICRISAT
Total number of pods per plant, expressed as mean of ten plants.

Total unacceptable pods/Plant
ICRISAT
Mean of ten plants

Unusual reticulation
ICRISAT
Textual description of unusual pod reticulation

MORPHOLOGICAL DATA

FLOWER CHARACTERISTICS

Crescent Type

ICRISAT

Definition to be determined

Flower Color

ICRISAT

Dark Yellow, Lemon Yellow, Yellow, Yellow with red spots, Orange brown, other

Flower size

ICRISAT

Coded as 1=Very Small 3=Small 5=Medium 7=Large 9=Very Large

Peg Color

ICRISAT

Green, pink, purple, or mixed

Peg Number

ICRISAT

Actual count of pegs (average of ten plants)

Standard crescent

ICRISAT

Recorded as distinct, indistinct, absent

LEAF CHARACTERISTICS

Leaf color[3]

ICRISAT

Coded as dark green, bottle green, light green, or other

Leaf shape

ICRISAT

Coded as elliptical, oblong, obovate, lanceolate, other

Leaf size

ICRISAT

1=Very Small, 3=Small, 4=Medium Small, 5=Medium, 6=Medium Large, 7=Large, 9=Very Large

Stipule size

ICRISAT

3=Small, 7=Large, 9=Very Large

Stipule type

ICRISAT

To be determined

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[3]Royal Horticultural Society Colour Charts could be used for grades.

STEM CHARACTERISTICS

Branching habit

ICRISAT

Alternate, sequential, or irregular

USDA

1=Sparse, 5=Moderate, 9=Profuse

Growth Habit

ICRISAT

Whether growth occurs as runner, spreading bunch, or erect bunch

Plant Height

ICRISAT

Measured from ground level to tip of meristematic tissue in cm.

Plant type

USDA

Bunch, Runner, Valencia, Bunch/Runner, Runner/Bunch, Virginia, Spanish, Mixed, Chinese

Plant Vigor

ICRISAT

Recorded as 3=Highly Vigorous, 5=Vigorous, 7=Normal, 9=Weak

USDA

1=Normal, 5=Moderately vigorous, 8=Vigorous, 9=Extremely vigorous

Plant Width

ICRISAT

Measured at the widest point in cm

Stem Colour

ICRISAT

Coded as green, pink, purple, or mixed

DISEASE-PEST DATA

DISEASE RESISTANCE

Aspergillus flavus

ICRISAT

Coded from 1-9, where 1 = high resistance

Aspergillus niger

ICRISAT

Coded as 1-9, where 1 = high resistance

Cercospora arachidicola
ICRISAT
Coded from 1-9, where 1 = high resistance

Cercosporidium personatum
ICRISAT
Coded from 1-9, where 1 = high resistance

Cercospora sp.
USDA
1=Highly resistant, 2=Normal, 3=Susceptible, 4=Highly susceptible

Cylindrocladium black rot
ICRISAT
Coded from 1-9, where 1 = high resistance

Peanut Mottle Virus
ICRISAT
Coded from 1-9, where 1 = high resistance

Puccinia arachidis
ICRISAT
Coded from 1-9, where 1 = high resistance

Rhizoctonia batatioola
ICRISAT
Coded from 1-9, where 1 = high resistance

Rosette virus
ICRISAT
Coded from 1-9, where 1 = high resistance

Sclerotinia sp.
ICRISAT
Coded from 1-9, where 1 = high resistance

Stem rot (*Sclerotium rolfsii*)
ICRISAT
Coded from 1-9, where 1 = high resistance

Stunt Virus
ICRISAT
Coded from 1-9, where 1 = high resistance

Tomato Spotted Wilt Virus
ICRISAT
Coded from 1-9, where 1 = high resistance

INSECT RESISTANCE

Aphid (*Aphis craccivora*)

ICRISAT

Coded from 1-9, where 1 = high resistance

Jassid (*Empoasca* sp.)

ICRISAT

Coded from 1-9, where 1 = high resistance

Leaf miner (*Stomopteryx subsecivilla*)

ICRISAT

Coded from 1-9, where 1 = high resistance

Pod borer (Earwig-*Euborellia stali*)

ICRISAT

Coded as 1-9, where 1 = high resistance

Southern corn root worm (*Diabrotica undecimpunotata* var. *howardi*)

ICRISAT

Coded from 1-9, where 1 = high resistance

USDA

1=No damage, 2= 1-10 %, 3=11-25 %, 4=26-50 %, 5=75 %

Thrip (*Frankliniella* sp., *Scirtothrips dorsalis*)

ICRISAT

Coded from 1-9, where 1 = high resistance

USDA

1=No injury, 2=Little injury, 3=Moderate injury, 4=Severe injury

NEMATODE RESISTANCE

***Belonolaimus* sp.**

USDA

Coded from 1-9, where 1 = Resistant

Meloidogyne arenaria

USDA

Coded from 1-9, where 1 = Resistant

Meloidogyne hapla

USDA

Coded from 1-9, where 1 = Resistant

Nematode

ICRISAT

Coded from 1-9, where 1 = High Resistance

BIOCHEMICAL DATA

OIL CHARACTERISTICS

Oil percentage

ICRISAT

Weight of oil extracted/total weight of sample

PROTEIN CHARACTERISTICS

Protein percentage

ICRISAT

Standard method of determination and recording (needs to be agreed upon)