

TROPICAL AND SUB TROPICAL FRUIT CHARACTERIZATION AND EVALUATION DATA SHEET

(Mango, Banana, Citrus, Avocado, Litchi, Coffee)



National Center for Fruit Development (NCFD)

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Publisher:

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Photo Credit : Tropical Horticulture Center, Sarlahi, Citrus Development Center, Palpa, Coffee Development Center, Gulmi

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Published Date : 2081 Ashadh (A.D.)

Government of Nepal
Ministry of Agriculture and Livestock Development
Department of Agriculture
National Centre for Fruit Development, Kirtipur, Kathmandu



Foreword

Varietal characterization of fruit crops is very important to identify a particular variety within a species. In order to breed a variety, to identify traits of interest, register a variety and maintain its true phenotypic characteristics for generations, developing reliable descriptors and evaluation criteria are the pre-requisites. These standard descriptors will help in standardization of phenological study and help in generating reliable varietal characteristics that form the basis of identification and labelling of fruit varieties for different purposes. In Nepal, very less varietal study and phenotypic observations have been documented for fruit crops.

Fruits greatly contribute in improving the livelihoods and nutrition security of the people. Additionally, they provide health benefits and have social, cultural, historical, and environmental importances. Being a country rich in biodiversity (including the agricultural biodiversity) fruits form an invaluable biological asset that contribute immensely to the nation's biodiversity and many fruits have a strong case for geographical indication. There are many indigenous fruits and commercial fruits grown in Nepal. The horticultural development centers and research stations have good collection of fruit germplasm which need to be characterized for which a systematic observation is required. Therefore, the National Centre for Fruit Development (NCFD) has prepared this document covering major tropical, subtropical, warm temperate and temperate fruit crops. This covers internationally developed descriptors of different parameters which will enable the record keeper to records with ease and in a systematic manner.

This is a technical book which I believe will be very helpful in describing our valuable germplasm assets conserved in our governmental horticulture centers which could be further extended to universities and private research centers as well. I express my sincere and deep gratitude to all the staff involved in preparation of this very important document. Special thanks goes to Mr. Santosh Paudel who coordinated to bring this book in this shape as well as senior horticulture experts, and all experts who have worked tirelessly to bring the task assigned to them to a completion.

Thank you.

June, 2024

Shanta Karki, PhD
Chief, National Centre for Fruit Development

Editorial



Biodiversity conservation and utilization is one of the federal mandates of the National Centre for Fruit Development (NCFD). In this regard, NCFD has envisioned a fruit germplasm conservation and utilization mission in collaboration with universities, agriculture institutes, and the Nepal Agriculture Research Council in Nepal. NCFD has started establishing field gene banks on all its government farms, including provincial horticultural farms, by this year. With deliberate planning of fruit variety registration and germplasm conservation, we have prepared a fruit germplasm characterization and evaluation datasheet based on fruit variety descriptors developed by the IPGRI, IBPGR, ECPGR, and UPOV. With this datasheet, we aim to identify anonymous fruit genetic resources as well as properly document them for further research and fruit breeding.

In Nepal, fruit varieties have been introduced from many countries over time. Similarly, there are many local and indigenous varieties, along with landraces and wild relatives of fruits, in Nepal. The fruit germplasm introduced long ago might have changed in their genetic makeup for multiple reasons. On the other hand, fruit germplasm in many public places all over the country has been overlooked from a conservation and utilization perspective. There is also limited research in fruit variety characterization and evaluation, as well as fruit breeding, to develop improved varieties in Nepal. Meanwhile, a very small number of fruit varieties have been registered, enabling their multiplication and use. So, in order to address these issues, the characterization of every accession and their subsequent evaluation are crucial.

This datasheet of thirteen different tropical, sub-tropical, warm-temperate, and temperate fruits has been prepared in this standard format following advice on descriptors from crop experts within the country. Furthermore, parameters useful in our context for the management and maintenance of the collection are used. The NCFD encourages the collection of data in the four categories: 1. accession (passport descriptor); 2. collection (information of origin and parentage); 3. and 4. characterization and preliminary evaluation.

NCFD wishes to place on record its sincere thanks to the numerous horticulture experts who have contributed directly or indirectly to the development of this datasheet. Dr. Shanta Karki supervised the meetings, provided technical expertise, and guided the team involved in the production of this datasheet. Meanwhile, Mrs. Yam Kumari Shrestha, Mrs. Shova Sharma, Mrs. Tara Sharma, Mrs. Manita Tamang, Mrs. Suprabha Pandey, Mrs. Kabita Sharma, Mr. Youbraj Bhusal, Mr. Surya Prasad Baral, Mr. Samyam Pandit, and Mr. Sudeep Chaudhary contributed to collecting preliminary parameter lists to prepare the draft of the datasheet. Mr. Gopal Prasad Shrestha, Mr. Bhairab Raj Kaini, and Mr. Padam Prasad Adhikari provided technical advice in preparing this datasheet.

With this piece of work, we believe we can reinvigorate our horticultural farm centers with a more scientific base and evidence to contribute towards fruit sector research and development. Simultaneously, it will also help all the researchers, academicians, students, and development workers in the horticulture sector in many ways. Errors and omissions are the responsibility of the editor. Any suggestions for improvements and modifications will be highly appreciated by the National Centre for Fruit Development, Kirtipur, and by the editor.

July, 2024

Santosh Paudel
Editor

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Mango (*Mangifera indica* L.) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI, 2006. Descriptors for Mango (*Mangifera indica* L.). International Plant Genetic Resources Institute, Rome, Italy)



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Scoring and Coding the Parameters

The internationally accepted standards for the scoring or coding of descriptor states should be followed as indicated below:

- (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 Colour Chart for Plant Tissues, are strongly recommended for all ungraded 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) many quantitative characters, which are continuously variable, are recorded 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	

is the expression of a character. 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 susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;

- (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 central leaf lobe: Shape of central leaf lobe

- 1 Lanceolate
- 2 Elliptic
- 3 Linear

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

- Terminal leaflet
- 0 Absent
 - 1 Present

- (h) Passport data is the prerequisite before characterizing and evaluating the genetic resources;
- (i) blanks are used for information not yet available;
- (j) for accessions which are not generally uniform for a descriptor (e.g. mixed collection, genetic segregation), the mean and standard deviation could be reported where the Definitions and use of the descriptors 3 descriptor is continuous. Where the descriptor is discontinuous, several codes in the order of frequency could be recorded, or other publicized methods can be utilized, 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

Information of Origin and Parentage (Collecting Descriptor)

1. Collector's Number:
(Passport data is prerequisite for this number-given by Gene-Bank)
2. Collecting Institute:
(Institute or person collecting/sponsoring the original sample)
3. Date of collection of original samples (Month/Year):
4. Country of collection or country where cultivar/variety bred:
5. Province/State from where sample is collected:
6. Location of collection site:
(Kilometers and direction from nearest town/village/landmark)
7. Latitude of collection site:
(Degrees and minutes followed by N (north) or S (south), e.g. 1030S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 7625W)
9. Altitude of collection site:
(Elevation above sea level in meters)
10. Collection source:
(1-Wild, 2-Farm land, 3-Farm store, 4-Backyard, 5-Village market, 6-Commercial market, 7-Institute, 8-Other, Specify in Notes)
11. Status of sample:
(1-Wild, 2-Weedy, 3-Breeder's line, 4-Primitive cultivar / landrace, 5-Advanced cultivar (bred), 6- Other, specify in Notes)
12. Local Name:
(Name given by farmer to cultivar/landrace/weed)
13. Types of samples:
(1-Fruit, 2-Seed, 3-Sapling/Seedling, 4-Shoot/Budwood/Stem cutting, 5-*In Vitro* Plantlet) 99-Others (Specify)
14. Nature of vegetative sample:
(0-Not vegetative (seed) 1-Cuttings - for grafting, 2-Cuttings - for rooting, 3-Rooted plants, 4-Tissue culture, 5-Other, specify in Notes))
15. Prevailing Stresses:
(Information on main associated biotic (pests and diseases) and abiotic (drought) stresses)
16. Genetic Erosion:
(Estimate the rate of genetic erosion of the species occurring in the region of collection
1-Slow 2-Moderate 3-High 4-Very high)
17. Seasonality/Fruit availability:
(1 Available only in main season
2 Available in off-season
3 Available throughout the year
4 Available in alternate years)
18. End Use:
(1-Scion cultivar - dessert, 2-Scion cultivar - processing, 3-Dual or multipurpose consumption, 4- Clonal rootstock, 5-Clonal inters tock, 6-Seedling rootstock, 7-Ornamental/pollinator (pollinizer), 8-Botanical (wild) species, 9-Other (specify in the NOTES))

Environment and Site Information (Characterization and evaluation site descriptors)

- Country of characterization and/or evaluation:
- Site (research institute/farm center/farm):
 - Name of farm or institute:
 - Latitude:
 - Longitude:
 - Elevation: (masl)
 - Slope: (degree)
 - Slope aspect: (ex-NE, SW, etc.)
- Evaluator's name and address:
- Evaluation Year: (Starting date: MM/YYYY)
- Sowing/grafting/budding/layering/stooling date :
- Harvest date:
- Evaluation environment:
 Environment in which characterization/evaluation/screening was carried out: 1-Field, 2-Screenhouse/Greenhouse, 3-Glasshouse, 4-Laboratory, 99-Other (specify in descriptor Notes)
- Age of tree: years
- Seed germination%:
- Number of days to germination [d]:
- Field Spacing: P-P: (m), R-R: (m)
- Fertilizer:
 Specify types used, doses, frequency of each and method of application
- Plant protection:
 Specify pesticides used, doses, frequency of each and method of application
- Climate of the site:
 - Temperature (degree Celsius):
 Max Min Mean
 (Seasonal maximum, minimum and mean temperature)
 - Rainfall (mm):
 (Annual average, state number of recorded years)
 - Wind (Km s-1)
 (Annual maximum wind velocity)
 - Frost:
 Duration of temperature below freezing days
 Date of most recent frost: (DDMMYYYY)
 - Relative humidity:
 Diurnal range: %
 Seasonal range: %
 - Light (Shady or Sunny)
 - Daylength : (hr)
 Provide either the monthly (mean, maximum, minimum) or the seasonal (mean, maximum, minimum)

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Average of at least two ‘on-years’ (production years) data recorded on three trees, unless otherwise stated. Please refer the Mango Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np.

1. Tree descriptor

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree Age (Years)									
Tree Type									
Height of mature tree [m]									
Trunk circumference									
Crown Diameter									
Crown Shape									
Tree growth habit									
Foliage density									

***Tree Type:** 1- Seedling (monoembryonic/polyembryonic), 2-Grafted, 3- others

***Height:** (Measured from ground level to the top of the tree) 1-Short (≤ 6.0), 2- Medium (6.1 – 9.0), 3 -Tall (9.1 – 12.0), 4- Very tall (> 12.0)

***Trunk circumference** [cm]: Measured at 50 cm above ground level in the mature tree

***Crown diameter** [m]: Measured as the mean diameter using two directions (North-South and East West)

***Crown Shape:** 1-Oblong, 2-Broadly pyramidal, 3-Semi-circular, 4-Spherical, 5- Other 4)

***Tree growth habit:** 1-Erect, 2-Spreading, 3-Drooping, 4- Other

***Foliage density:** 3-Sparse, 5-Intermediate, 7-Dense

Tree Photographs:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

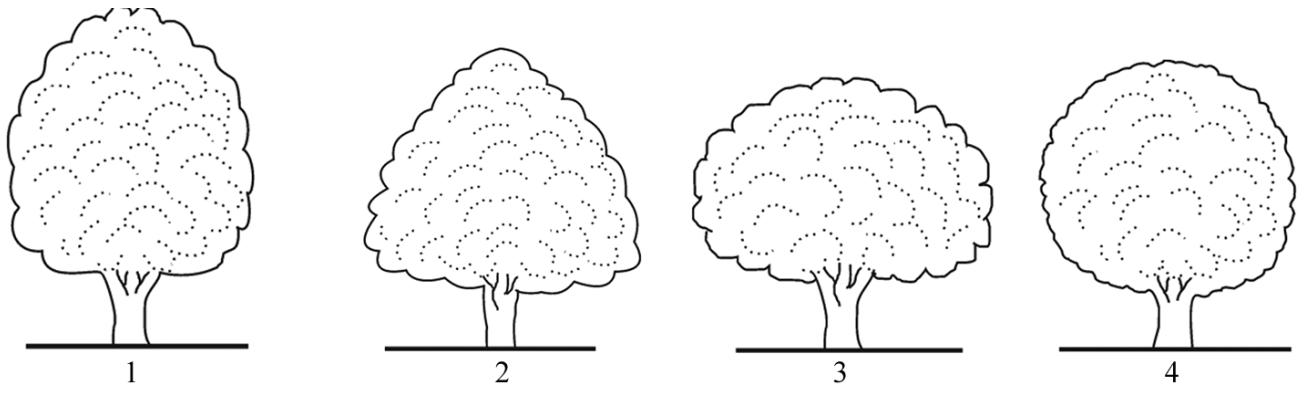


Figure 1 : Crown Shape

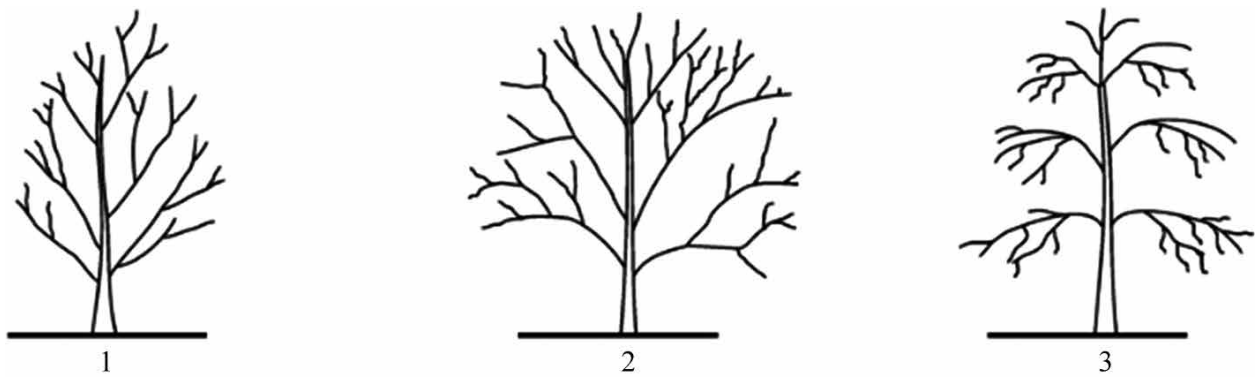


Figure 2 : Tree growth habit

2. Leaf descriptors

Do not select leaves that are abnormal due to the disease, nutritional imbalances and excessive vigour. For qualitative characteristics, indicate the predominant one.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf blade shape									
Leaf attitude in relation to branch									
Leaf blade length [cm]									
Leaf blade width [cm]									
Petiole length [cm]									
Thickness of petiole									
Leaf venation: - -Angle of secondary veins to the midrib -Curvature of secondary veins									
Leaf texture									
Leaf apex shape									
Leaf base shape									
Leaf margin									
Leaf pubescence									
Color of young leaf									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Color of fully developed leaf									
Leaf fragrance									

- * **Leaf blade shape:** 1-Elliptic, 2-Oblong, 3-Ovate, 4-Obovate, 5-Lanceolate, 6-Oblanceolate, 7-Other
- * **Leaf attitude in relation to branch:** 1-Semi-erect, 2-Horizontal, 3-Semi-drooping, 4-Other
- * **Leaf blade length [cm]:** Average of 10 mature leaves measured from the base to the tip of the leaf Blade
- * **Leaf blade width [cm]:** Average of 10 mature leaves measured at the widest point
- * **Petiole length [cm]:** Average length of 10 mature leaves measured from the stem to the base of leaf blade
- * **Thickness of pelvinus:** 1-Thin, 2-Thick and tapering
- * **Angle of secondary veins to the midrib:** 1-Narrow (< 45°), 2 Medium (45 – 60°), 3 Wide (> 60°)
- * **Curvature of secondary veins:** 0-Absent, 1-Present
- * **Leaf texture:** 1-Coriaceous, 2-Chartaceous, 3-Membranous
- * **Leaf apex shape:** 1-Obtuse, 2-Acute, 3-Acuminata
- * **Leaf base shape:** 1-Acute, 2-Obtuse, 3-Round
- * **Leaf margin:** 1-Entire, 2 Wavy
- * **Leaf pubescence:** 0-Absent, 1-Present
- * **Color of young leaf** (Recorded on 5-10 days old leaves): 1-Light green, 2-Light green with brownish tinge, 3-Light brick red, 4-Reddish brown, 5-Deep coppery tan, 6-Other
- * **Color of fully developed leaf:** 1-Pale green, 2-Green, 3-Dark green, 4-Other
- * **Leaf fragrance** (Recorded in fully developed mature leaf when crushed): 0-Absent, 1-Mild, 2-Strong

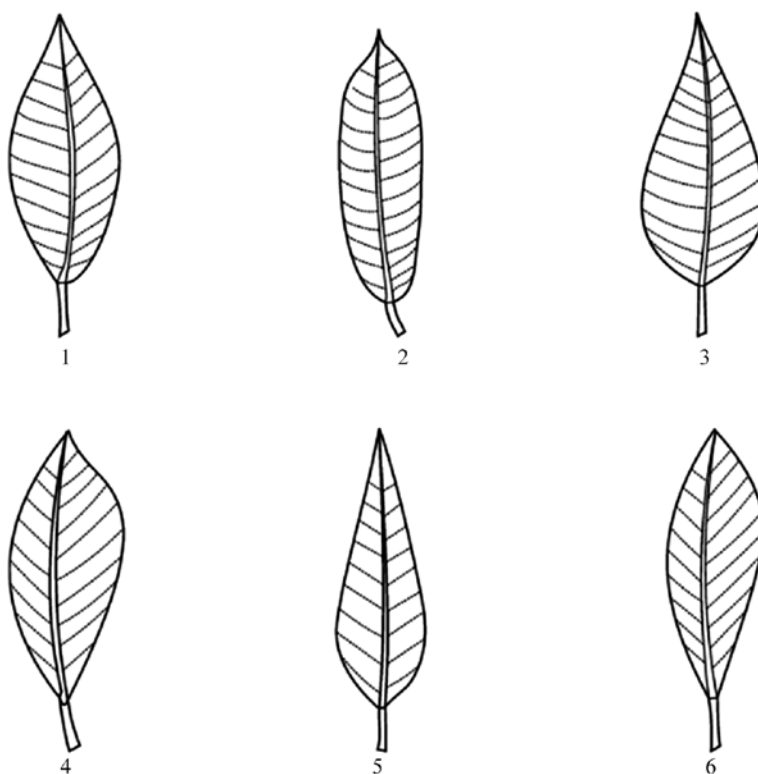


Figure 3 : Leaf blade shape

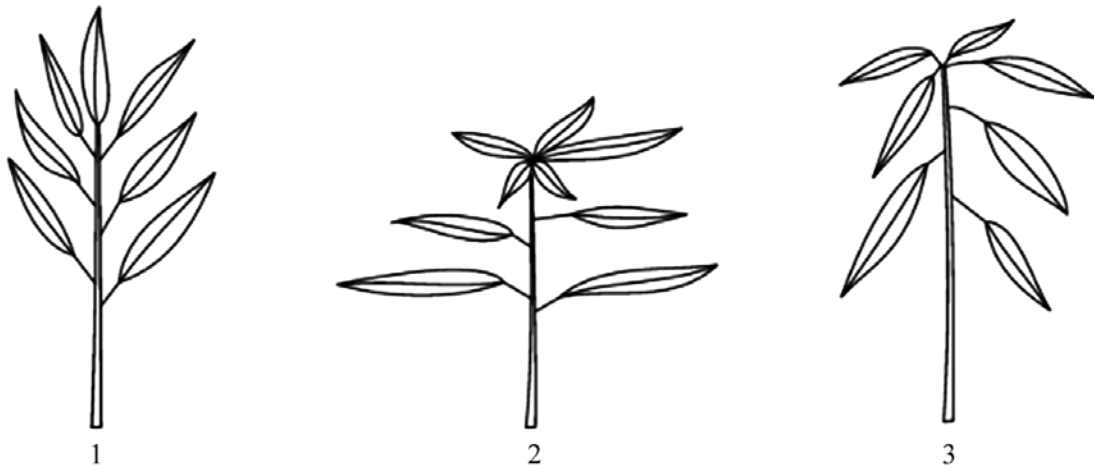


Figure 4 : Leaf attitude in relation to branch

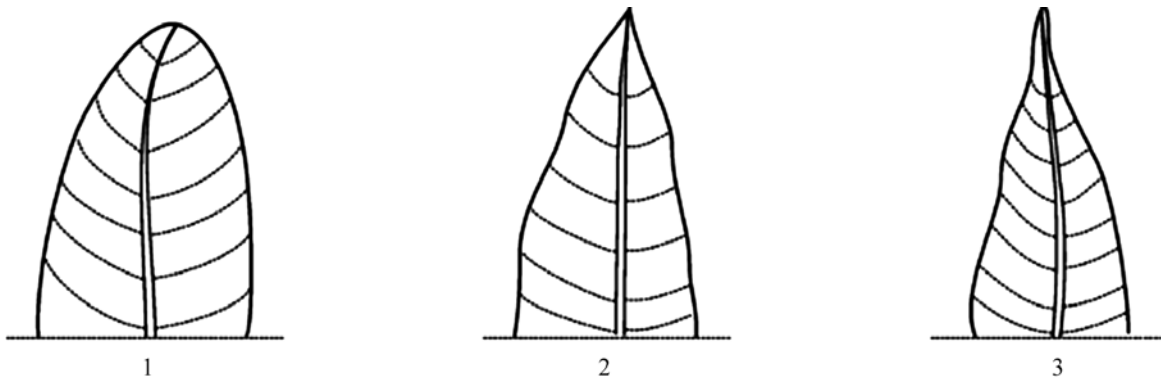


Figure 5 : Leaf apex shape

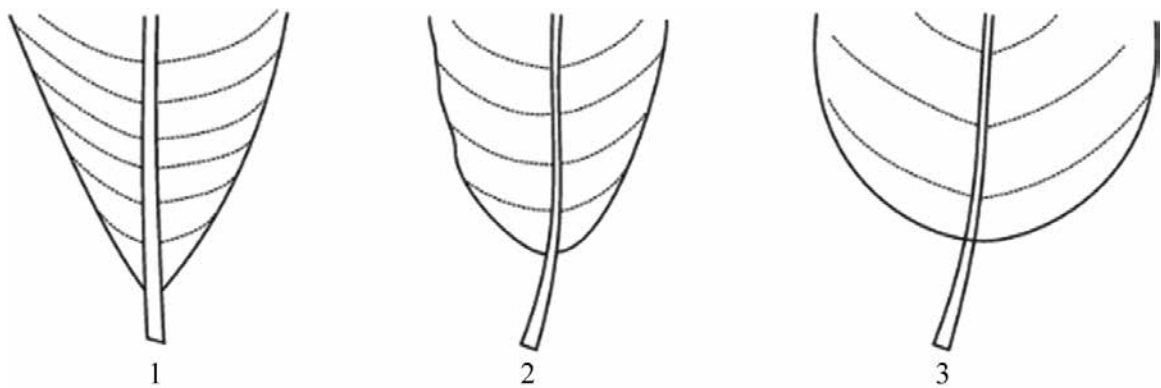


Figure 6 : Leaf base shape

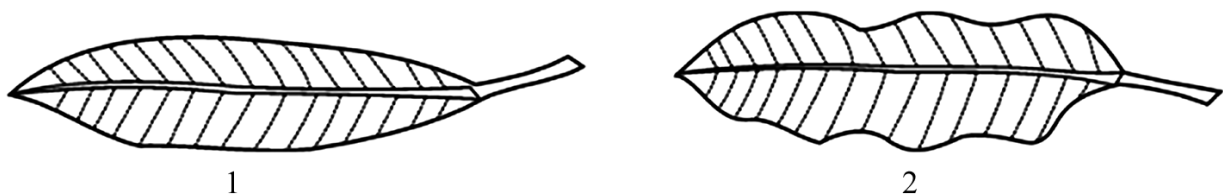


Figure 7 : Leaf margin

3. Inflorescence / flower descriptor

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Number of years to first flowering [y]									
Flowering duration [d]									
Secondary/off-season flowering									
Regularity of flowering									
Inflorescence position									
Inflorescence axis growth habit									
Inflorescence shape									
Inflorescence length [cm]									
Inflorescence width [cm]									
Peduncle length [cm]									
Peduncle width [cm]									
Pubescence of inflorescence rachis									
Hermaphrodite flowers in the inflorescence [%]									
Presence of leafy bracts									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Density of flowers in inflorescence									
Type of flower									
Inflorescence color									
Length of the stamen in relation to pistil									
Nature of disc									
Number of stamens/ staminodes									
Intensity of anthocyanin coloration in mature flowers									

***Flowering duration** [d]: Number of days from first flower opening until end of flowering. Record the average of at least four years.

***Secondary/off-season flowering:** 0-Absent, 1-Rare, 2-Intermediate, 3-Frequent

***Regularity of flowering:** 1-Regular, 2-Biennial (alternate years), 3-Irregular

***Inflorescence position:** 1-Terminal, 2-Axillary, 3-Other

***Inflorescence axis growth habit:** 1-Semi-erect, 2-Horizontal, 3-Drooping

***Inflorescence shape:** 1-Conical (narrowly pyramidal), 2-Pyramidal, 3 Broadly pyramidal

***Inflorescence length** [cm]: Average of 10 inflorescences

***Peduncle length and width** [cm]: Average of 10 inflorescences

***Pubescence of inflorescence rachis:** (Recorded on rachis of 10 inflorescences): 0-Absent, 1-Puberulous, 2-Pubescent

***Hermaphrodite flowers in the inflorescence** [%]: Average of 10 inflorescences taken from all directions and center of tree

***Presence of leafy bracts:** 0-Absent, 1-Present

***Density of flowers in inflorescence:** 3-Sparse, 5-Medium, 7-Dense

***Type of flower:** 1-Pentamerous, 2-Tetramerous, 3-Both

***Inflorescence color** (Recorded on main and secondary axes): 1-Whitish, 2-Yellowish, 3-Yellow, 4-Light green, 5-Green with red patches, 6-Light orange, 7-Pink, 8-Dark pink green, 9-Purple, 10- Light red, 11-Red, 12-Dark red, 13-Crimson, 14- Other

*Length of the stamen in relation to pistil: 1-Shorter, 2-Equal, 3-Longer

*Nature of disc: 1-Swollen, broader than ovary, 2-Narrow, reduced or absent

*Number of stamens/staminodes:

1 10-12 (5-6 fertile)

2 5 (all fertile)

3 5 (2-3 fertile)

4 5 (1 fertile)

*Intensity of anthocyanin coloration in mature flowers: 3-Low, 5-Medium, 7-High

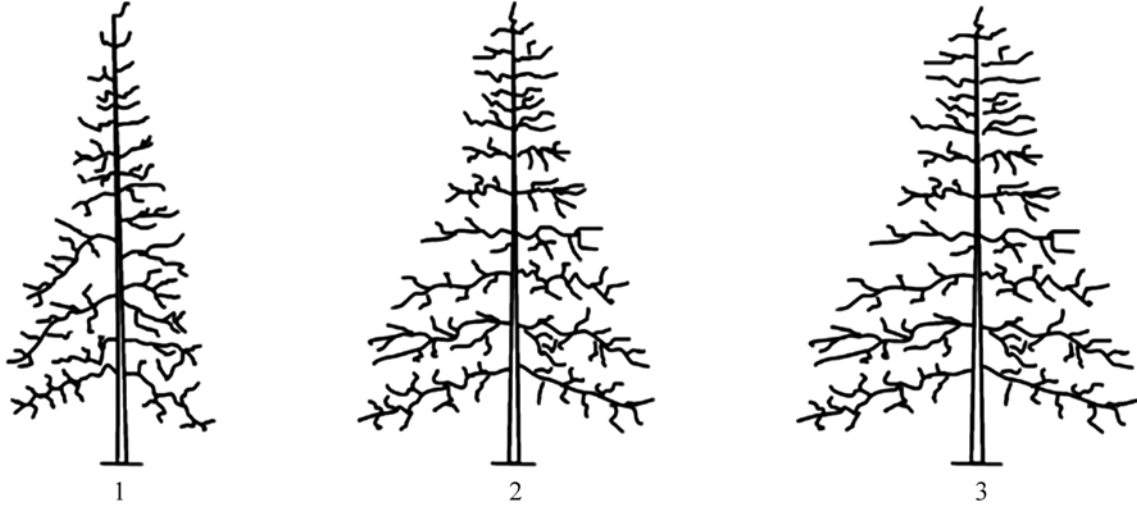


Figure 8 : Inflorescence Shape

Flower Photographs

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

4. Fruit Descriptor

Recorded on 20 well developed fruits at harvest time, unless otherwise specified.

Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Code	Detail	Code	Detail	Code
Number of years to first fruiting [y]					
Fruiting duration - Starting date - Ending date					
Fruit bearing intensity					
Fruit length [cm]					
Fruit diameter [cm]					
Fruit weight [g]					
Fruit shape					
Shape of fruit apex					
Fruit attractiveness					
Skin color of ripe fruit - Fruit ground color - Fruit blush					
Fruit skin thickness [mm]					
Fruit skin surface texture					
Density of lenticels on fruit skin					
Fruit stalk insertion					
Depth of fruit stalk cavity					

Parameter	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Code	Detail	Code	Detail	Code
Fruit stalk attachment					
Fruit neck prominence					
Slope of fruit ventral shoulder					
Fruit beak type					
Fruit sinus type					
Fruit skin waxiness					
Skin color of ripe fruit					
Pulp color of ripe fruit					
Pulp texture of ripe fruit					
Adherence of fruit skin to pulp					
Quantity of latex oozing from peduncle					
Fruit pulp thickness [cm]					
Quantity of fiber in pulp					
Adherence of fiber to fruit skin					
Pulp content					
Pulp juiciness					
Pulp aroma					
Presence of turpentine flavor					

- ***Fruit bearing intensity:** 1-Low, 2-Medium, 3-High
- ***Fruit length and diameter** [cm]: Average of 20 fruits measured from the base to the tip of the fruit and at the widest point
- ***Fruit shape:** 1-Oblong, 2-Elliptic, 3-Roundish, 4-Ovoid, 5-Obovoid, 6-Other
- ***Shape of fruit apex:** 1-Acute, 2-Obtuse, 3-Round, 4-Other
- ***Fruit attractiveness** (Combined assessment of shape, size and appearance, coloration, etc.): 1-Poor, 2-Average, 3-Good, 4-Excellent
- ***Fruit ground color:** 1-Green, 2-Yellow, 3-Orange, 4-Purple, 5-Red, 6-Other
- ***Fruit blush:** 1-Orange, 2-Purple, 3-Red, 4- Other
- ***Fruit skin thickness** [mm]: Average of 10 ripe fruits
- ***Fruit skin surface texture:** 1-Smooth, 2-Rough
- ***Density of lenticels on fruit skin:** 3-Sparse, 5-Medium, 7-Dense
- ***Fruit stalk insertion:** 1-Vertical, 2-Oblique
- ***Depth of fruit stalk cavity:** 0-Absent, 1-Shallow, 2-Medium, 3-Deep, 4-Very deep
- ***Fruit stalk attachment:** 3-Weak, 5-Intermediate, 7-Strong
- ***Fruit neck prominence:** 0-Absent, 1-Slightly prominent, 2-Prominent, 3-Very prominent
- ***Slope of fruit ventral shoulder:** 1-Slopping abruptly, 2-Ending in a long curve, 3-Rising and then rounded
- ***Fruit beak type:** 1-Perceptible, 2-Pointed, 3-Prominent, 4-Mammiform
- ***Fruit sinus type:** 0-Absent, 1-Shallow, 2-Deep
- ***Fruit skin waxiness:** 1-Waxy, 2-Non-waxy
- ***Skin color of ripe fruit:** 1-Green, 2-Greenish yellow, 3-Yellow, 4-Green with red blush, 5-Green with purple patches
- ***Pulp color of ripe fruit:** 1-Light yellow, 2-Golden yellow, 3-Yellow orange, 4-Orange, 5-Greenish yellow, 6-Yellow, 7-Light orange, 8-Dark orange, 9-Other
- ***Pulp texture of ripe fruit** (Recorded on fully ripe fruits): 3-Soft, 5-Intermediate, 7-Firm
- ***Adherence of fruit skin to pulp:** 0-Absent (free), 3-Weak, 5-Intermediate, 7-Strong
- ***Quantity of latex oozing from peduncle:** 0-Absent, 3-Low, 5-Medium, 7-High
- ***Fruit pulp thickness** [cm]: Recorded as mean of three measurements per fruit taken at basal, middle and apical portion of fruit. Average of 20 fruits.
- ***Quantity of fiber in pulp:** 0-Absent, 3-Low, 5-Intermediate, 7-High
- ***Adherence of fiber to fruit skin:** 3-Low, 5-Medium, 7-High
- ***Pulp content:** Ratio of pulp to skin plus stone
- ***Pulp juiciness:** 1-Slightly juicy, 2-Juicy, 3-Very juicy
- ***Pulp aroma:** 1-Mild, 2-Intermediate, 3-Strong
- ***Presence of turpentine flavor:** 0-Absent, 1-Mild, 2-Intermediate, 3-Strong

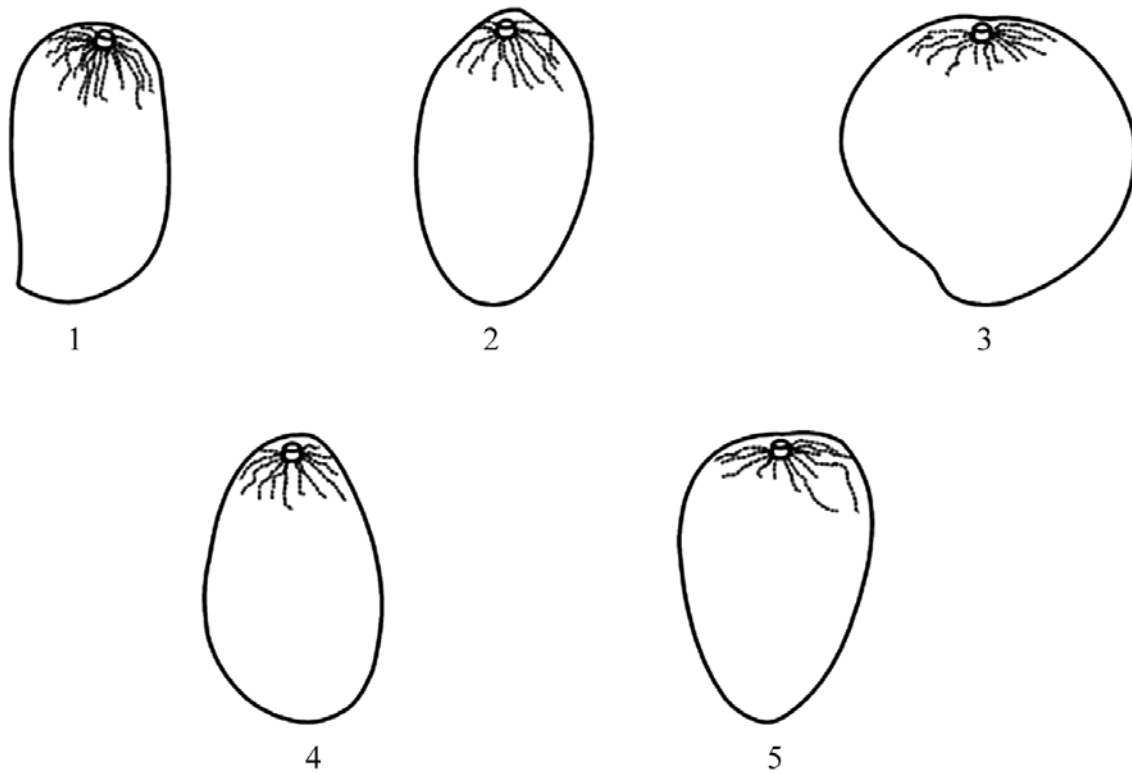


Figure 9 : Fruit Shape

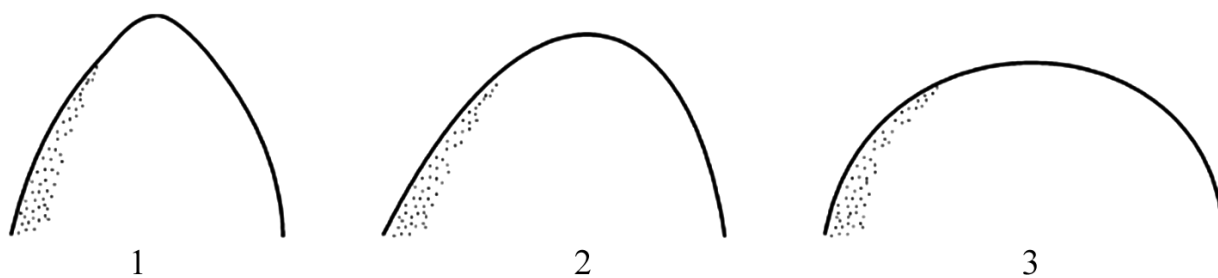


Figure 10 : Shape of Fruit apex

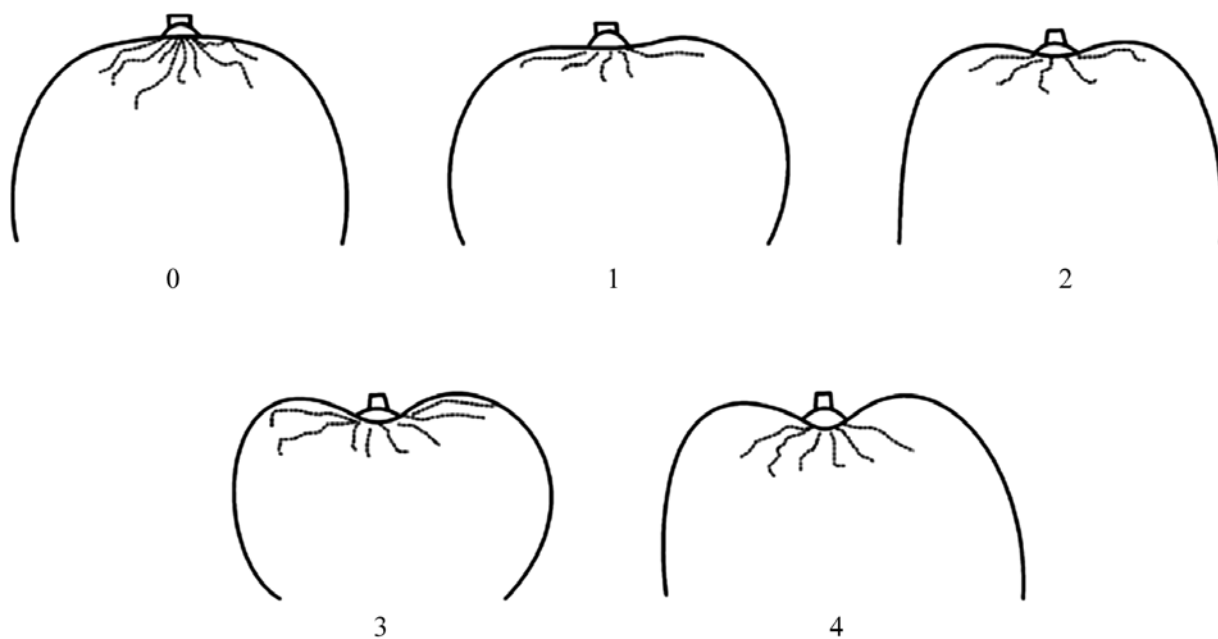


Figure 11 : Depth of fruit stalk cavity



Figure 12 : Fruit neck prominence

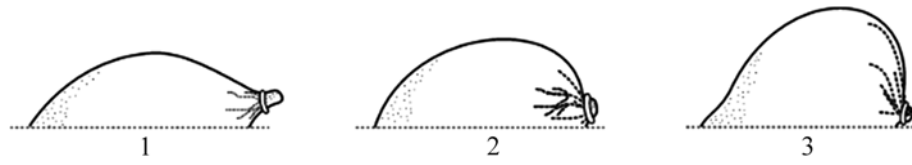


Figure 13 : Slope of fruit ventral shoulder



Figure 14 : Fruit beak type

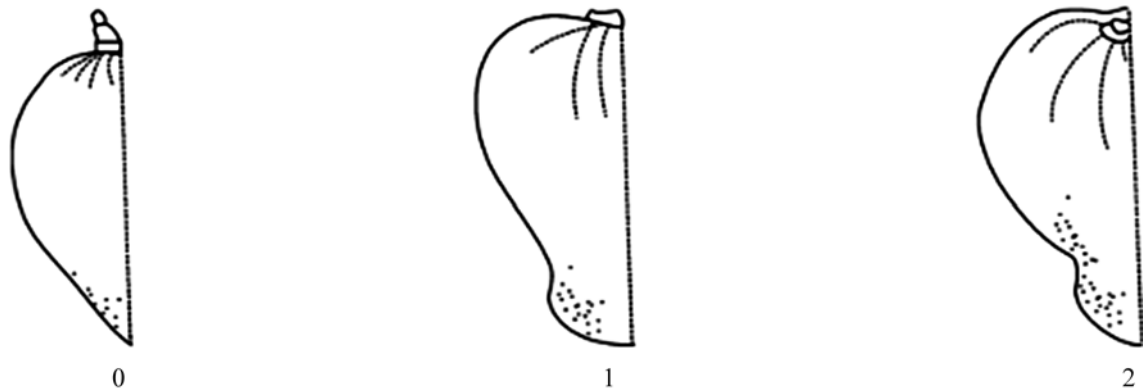


Figure 15 : Fruit sinus type

Fruit Photographs:

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
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5. Stone descriptors

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Stone length [cm]									
Stone width [cm]									
Stone thickness [cm]									
Stone weight [g]									
Veins on stone									
Pattern of stone venation									
Quantity of fiber on stone									
Adherence of fiber to stone									
Space occupied by seed inside the stone [%]									
Seed length [cm]									
Seed width [cm]									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Seed weight [g]									
Seed shape									
Type of embryony									

***Veins on stone:** 1-Level with surface, 2-Depressed, 3-Elevated

***Pattern of stone venation:** 1-Parallel, 2-Forked

***Quantity of fiber on stone:** 3-Low, 5-Intermediate, 7-High

***Length of stone fiber [cm]:** 1-Short (< 1.0), 2-Medium (1.0 – 1.5), 3-Long (> 1.5)

***Adherence of fiber to stone:** 3-Weak, 5-Intermediate, 7-Strong

***Space occupied by seed inside the stone [%]**

1. ≤ 25

2. 26 – 50

3. 51 – 75

4. 76 – 100

***Seed length [cm]:** Average of 20 seeds

***Seed width [cm]:** Average of 20 seeds at the widest point

***Seed weight [g]:** Average of 20 well developed/healthy seeds

***Seed shape:** 1-Ellipsoid, 2-Oblong, 3-Reniform, 4-Other

***Type of embryony:** 1-Monoembryony, 2-Polyembryony



1



2



3

Figure 16: Seed Shape

Stone Photographs:

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
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6. Evaluation Descriptors

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Yield per tree [kg/year]									
Fruit maturity period									
Fruit availability period [d]									
Fruit storage life [d]									
Eating quality									
Pulp total soluble solids [°Brix]									
Pulp titratable acidity [%]									

***Yield per tree** [kg/year]: (Average of 3 trees per accession)

***Fruit maturity period:** 1 Early 2 Medium 3 Late

***Fruit availability period** [d]: (Number of days from first to the last harvest date)

***Fruit storage life** [d]: (Number of days of storage of ripe fruits under ambient conditions after Harvest)

***Eating quality:** (Combined assessment of flavour, acidity, sweetness, aroma and astringency when ripe; quantitative measurement of TSS, acidity and sugars to be made)

1 Poor 2 Good 3 Very good 4 Excellent

***Pulp total soluble solids** [°Brix]: 1 Very low (< 10.0) 2 Low (10.1 – 14.0)

3. Medium (14.1 – 18.0) 4 High (18.1 – 22.0)

5. Very high (> 22.0)

***Pulp titratable acidity** [%]: 1 Low (< 0.20) 2 Medium (0.21 – 0.30)

3. High (0.31 – 0.40) 4 Very high (> 0.40)

7. Abiotic stress susceptibility

Scored under artificial and/or natural conditions, which should be clearly specified. These are coded on a susceptibility scale from 1 to 9, viz.,

1 Very low or no visible sign of susceptibility

3 Low

5 Medium

7 High

9 Very high

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Reaction to physiological disorders*									
Reaction to drought									
Reaction to wind									
Reaction to water logging									
Reaction to salinity (Soil or Water)									
Reaction to mineral toxicity									

*Reaction to physiological disorders:

1. Susceptibility to spongy tissue

2. Susceptibility to malformation - floral and vegetative

3. Other

8. Disease and Pests

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Example : Anthracnose	3	2	8	6	
1	Anthracnose					

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Example : Anthracnose	3	2	8	6	
2	Powdery mildew					
3	Sooty mould					
4	Fruit rot					
5	Fusarium spp. Mango malformation					
6	Mango hopper					
7	Mealy bug					
8	Fruit fly					
9	Stem/shoot borer					
10	Mango psyllid					
11	Stone weevil					
12	Thrips					

*Disease and pests should be scored in 1-9 scale where;

1-Very low or no visible sign of susceptibility

3- Low

5- Medium

7- High

9- Very High

Please refer the descriptor for more clarity on rating.

NOTES:

Please specify any additional information to be recorded regarding the accession which are not covered and stated as "Other" in above parameters.

Banana (*Musa Spp.*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI. Descriptors for Banana (*Musa Spp.*). International Plant Genetic Resources Institute, Rome, Italy)



National Center for Fruit Development (NCFD)

Kirtipur, Kathmandu, Nepal, Tel./Fax: 977-1-5905053

Email: ncfd.gov.np@gmail.com,

Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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 ungraded 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 is used;
- (e) many quantitative characters which are continuously variable are recorded on a 1-9 scale,

where: 1-Very low, 2-Very low to low, 3-Low, 4-Low to intermediate, 5-Intermediate, 6-Intermediate to high, 7-High, 8-High to very high, 9-Very high is the expression of a character.

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 susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;

- (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; (ii) a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

- 1 Toothed
- 2 Elliptic
- 3 Linear

- (g) absence/presence of characters is scored as in the following example: Terminal leaflet 0 Absent 1 Present
- (h) blanks are used for information not yet available;
- (i) for accessions which 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 can be utilized, such as Rana et al. (1991) or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;
- (j) 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.

Information of Origin and Parentage (Collecting Descriptor)

1. Collector's Number:
(Passport data is prerequisite for this number-given by Gene-Bank)
2. Collecting Institute:
(Institute or person collecting/sponsoring the original sample)
3. Date of collection of original samples (Month/Year):
4. Country of collection or country where cultivar/variety bred:
5. Province/State from where sample is collected:
6. Location of collection site:
(Kilometers and direction from nearest town/village/landmark)
7. Latitude of collection site:
(Degrees and minutes followed by N (north) or S (south), e.g. 1030S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 7625W)
9. Altitude of collection site:
(Elevation above sea level in meters)
10. Collection source:
(1-Wild habitat 2-Farm land 3-Market 4-Institute 5- Other, Specify in Notes: See details of each source in the descriptor)
11. Status of sample:
(1-Wild 2-Weedy 3-Breeder's line 4-Primitive cultivar / landrace 5-Advanced cultivar (bred) 6- Other, specify in Notes)
12. Local Name:
(Name given by farmer to cultivar/landrace/weed)
13. Types of sample:
(1-Sucker 2-Seed 3-Bud 4-Other)
14. Plant population density:
(3-Low 5-Intermediate 7-High)
15. Prevailing stresses:
(Information on associated biotic and abiotic stresses and the accession's reaction. Indicate if disease indexing was done at the time of collecting in descriptor notes.)
16. End Use:
(1-Dessert 2-Cooking 3-Beer/brew/wine 4-Animal feed 5-Medicinal 6-Other (specify))

Environment and Site Information (Characterization and evaluation site descriptors)

- Country of characterization and/or evaluation:
- Site (research institute/farm center/farm):
 - Name of farm or institute:
 - Latitude:
 - Longitude:
 - Elevation: (masl)
 - Slope:⁰
 - Slope aspect: (Ex: NW, SE)
- Evaluator's name and address:
- Planting Date:
- Harvest Date:
- Evaluation Environment:
- Field Spacing: P-P: (m) R-R: (m)
- Evaluation Year: (Starting date :MM/YYYY)
- Climate of the site:
 - Temperature (degree Celsius):
 - Max Min Mean
 - (Seasonal maximum, minimum and mean temperature)
 - Rainfall (mm):
 - (Annual average, state number of recorded years)
 - Wind (Km hr-1):
 - (Annual maximum wind velocity)
 - Frost:
 - Duration of temperature below freezing: days
 - Date of most recent frost: (DDMMYYYY)
 - Relative humidity:
 - Diurnal range: %
 - Seasonal range: %
 - Light: (3-Shady or 7-Sunny)

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Observations should be made ideally under standardized conditions. Most characters should be observed during the 2nd cycle of cultivation (ratoon crop), or from the plant crop if ratoon crop is not possible to obtain. Characters should be recorded when the first ripe fruit develop on the bunch unless otherwise specified. It is recommended that at least three plants growing near to each other be used in the appraisal. Please refer the Banana Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np.

1. Plant general appearance

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf habit									
Dwarfism									

***Leaf habit:** 1= Erect, 2= Intermediate, 3= Drooping, 4= Other

* **Dwarfism:** 1= Normal, 2= Dwarf type

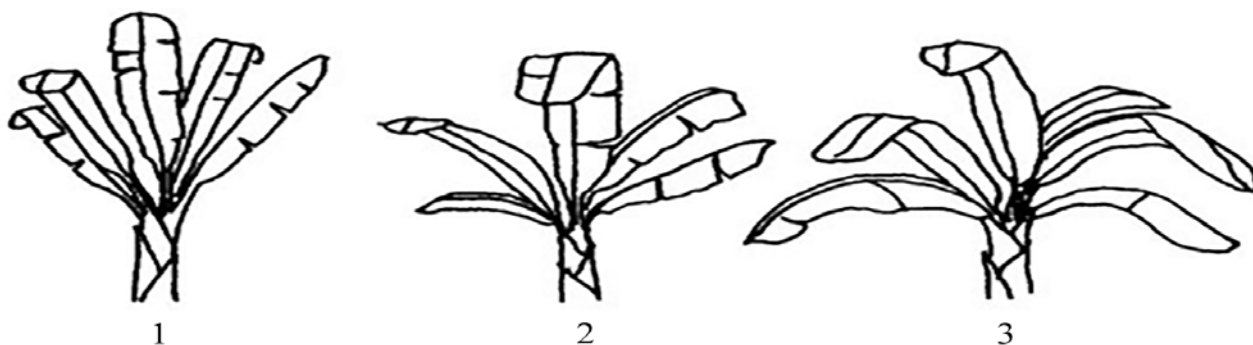


Figure 1 : Leaf habit

Leaf Photographs:

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
----------------	----------------

2. Pseudostem/Suckers

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Pseudostem height(m)									
Pseudostem aspect									
Pseudostem colour									
Pseudostem appearance									
Predominant underlying colour of the pseudostem									
Sap colour									
Wax on leaf sheaths									
Number of suckers									
Development of suckers									
Position of suckers									

* **Pseudostem height:** 1= ≤ 2 , 2= 2.1 to 2.9, 3= ≥ 3

* **Pseudostem aspect:** 1= Slender, 2= Normal, 3=Robust

* **Pseudostem colour:** 1= Green-yellow 2 = Medium green 3 = Green 4 = Dark green 5 = Green-red
6 = Red 7= Red-purple 8 = Blue 9 = Chimerical 10=Other (specify in descriptor)

***Pseudostem appearance:** 1 = Dull (waxy) 2 = Shiny (not waxy)

*Predominant underlying colour of the pseudostem: 1= Watery green 2= Light green 3= Green 4= Cream
5 = Pink-purple 6 = Red-purple 7 = Purple 8 = Other
(specify in descriptor)

***Sap colour:** 1= Watery 2= Milky 3= Red-purple 4= Other (specify in descriptor)

***Wax on leaf sheaths:** 1= Very little or no visible sign of wax 2 = Very few wax 3= Moderately waxy
4= Very waxy

***Number of suckers:** Record the number of suckers from soil level to point of emergence of the last leaf
(>30 cm height). Recorded only if no desuckering has taken place

***Development of suckers:** 1= Taller than parent plant 2= More than $3/4$ of the height of the parent plant
3= Between $1/4$ and $3/4$ of the height of the parent plant 4 = Inhibited

***Position of suckers:** 1= Far from parent plant (emerging >50 cm from parent plant)

2= Close to parent (vertical growth)

3= Close to parent (growing at an angle)

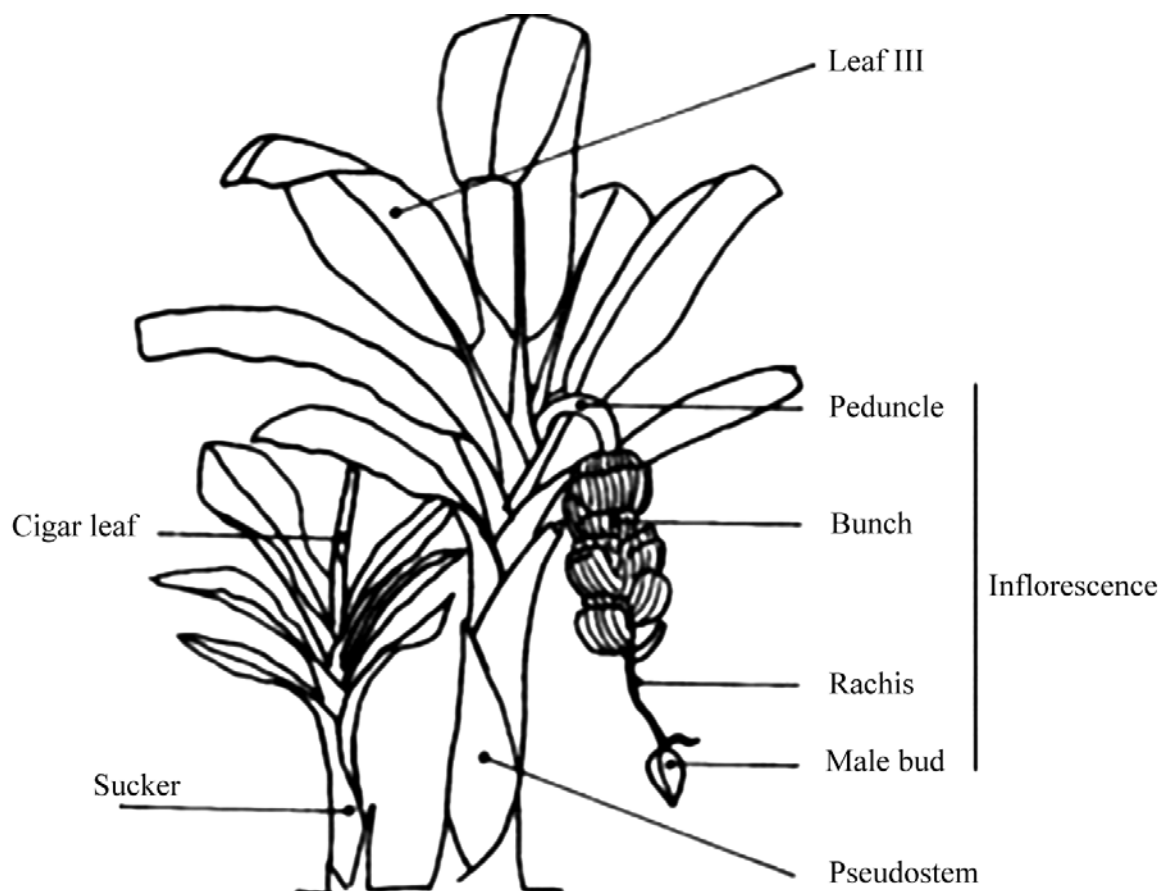


Figure 2 : Pseudostem/suckers (adapted from Champion, 1963)

Pseudostem Photographs:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

3. Petiole/midrib/leaf

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Blotches at the petiole base									
Blotches colour									
Petiole margins									
Wing type									
Petiole margin colour									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf blade length (cm)									
Leaf blade width (cm)									
Leaf ratio									
Petiole length (cm)									
Colour of leaf upper surface									
Appearance of leaf upper surface									
Color of leaf lower surface (Wax removed)									
Wax on leaves									
Shape of leaf blade base									
Leaf corrugation									
Color of midrib dorsal surface									
Blotches on leaves of water suckers									

- **Blotches at the petiole base:** 1 = Sparse blotching, 2= Small blotches, 3= Large blotches, 4= Extensive pigmentation, 5 = Without pigmentation
- **Blotches colour:** 1= Brown, 2 = Dark brown, 3 = Brown-black, 4 = Black-purple, 5 = Other
- **Petiole margins:** 1= Winged and undulating, 2 = Winged and not clasping the pseudostem, 3= Winged and clasping the pseudostem, 4= Not winged and clasping the pseudostem, 5= Not winged and not clasping the pseudostem

- **Wing type:** 1= Dry, 2= Not dry
- **Petiole margin colour:** 1= Green, 2= Pink-purple to red, 3= Purple to blue, 4= Other (specify in descriptor)
- **Leaf blade length (cm):** 1= ≤ 1 cm, 2= > 1 cm, 3= Cannot be defined
- **Leaf blade width (cm):** Measured at its maximum point 1= ≤ 170 cm, 2= 171 to 220 cm, 3= 221 to 260 cm, 4= ≥ 261 cm
- **Leaf ratio:** 3= ≤ 2 , 5= 2.4 to 2.6 7= ≥ 3
- **Petiole length (cm):** Recorded from the pseudostem to the lamina 1= ≤ 50 cm, 2= 51 to 70 cm, 3= ≥ 71 cm
- **Colour of leaf upper surface:** 1= Green-yellow, 2= Medium green, 3= Green, 4= Dark green, 5= Dark green with red-purple (presence of large blotches of red- purple), 6 = Blue, 7 = Other (specify in descriptor)
- **Appearance of leaf upper surface:** 1 = Dull, 2 = Shiny
- **Color of leaf lower surface (Wax removed):** 1 = Green-yellow, 2 = Medium green, 3 = Green, 4 = Dark green, 5 = Blue, 6= Red-purple, 7= Other
- **Wax on leaves:** Recorded on the lower surface 1= Very little or no visible sign of wax, 2 = Few waxes, 3 = Moderately waxy, 4= Very waxy
- **Shape of leaf blade base:** 1= Both sides rounded, 2= One side rounded, one pointed, 3= Both sides pointed
- **Leaf corrugation:** Presence of ridges perpendicular to the secondary ribs on the leaf upper surface 1= Even, smooth, 2= Few stripes, 3= Very corrugated
- **Color of midrib dorsal surface:** If pigmentation is seen, options are 4, 5 or 6. 1= Yellow, 2= Light green, 3= Green, 4= Pink-purple, 5= Red-purple, 6= Purple to blue, 7= Other
- **Blotches on leaves of water suckers:** Observed on young, non-inhibited water suckers (if the lamina is sword shaped, it is not a water sucker 1= Without blotches, 2= Little or narrow blotches, 3= Large purple blotches

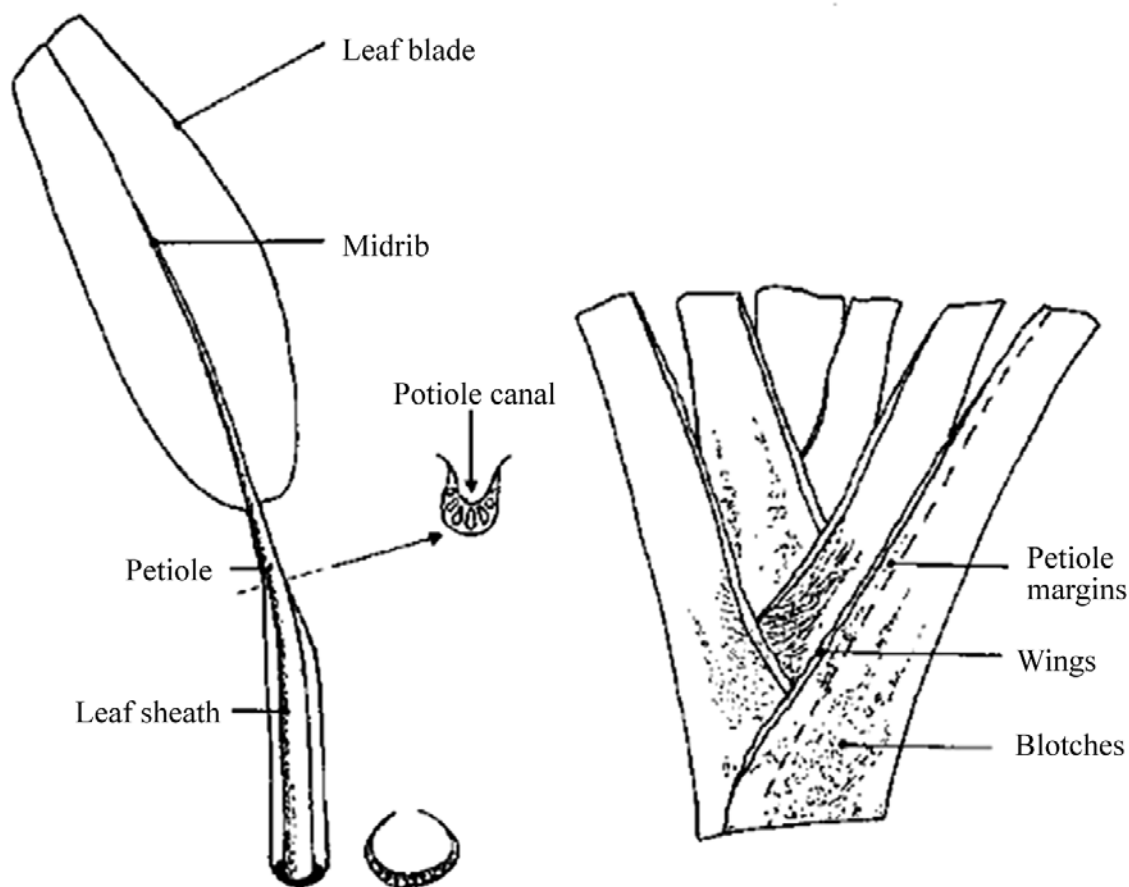


Figure 3 : Petiole/midrib/leaf (from Champion 1963 (left), De Langhe 1961 (right))

4. Inflorescence/male bud

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Peduncle length (cm)									
Peduncle width (cm)									
Peduncle colour									
Peduncle hairiness									
Bunch Position									
Bunch Shape									
Fruits									
Rachis type									
Male bud type									
Male bud shape									
Male bud size									

Peduncle length (cm): Measured from the leaf crown to the first hand of fruit 1= ≤30 cm 2= 31 - 60 cm 3= ≥61 cm

Peduncle width (cm): Recorded at mid-length 1= ≤6 cm, 2 =7 - 12 cm, 3= ≥13 cm

Peduncle colour: 1 =Light green, 2= Green, 3= Dark green, 4= Red or pink/purple, 5= With purple-brown to blue blotches, 6= Other

Peduncle hairiness: 1= Hairless, 2= Slightly hairy, 3= Very hairy, short hairs (similar to velvet touch), 4= Very hairy, long hairs (>2 mm)

Bunch Position: Angle from vertical to the general axis of the bunch 1 = Hanging vertically, 2= Slightly angled, 3= Hanging at angle 45°, 4= Horizontal, 5= Erect

Bunch Shape: 1= Cylindrical, 2= Truncated cone shape, 3= Asymmetric - Bunch axis is nearly straight, 4= With a curve in the bunch axis, 5= Spiral (all fruit is attached to a unique crown coiled around the stalk)

Fruits: Positioning of fruits on the crown 1= Uniseriate, 2= Biseriate, 3 =Biseriate and fused

Rachis type: 1 = Truncated, no bract scar below the last hand of fruit, 2= Present and male bud may be degenerated or persistent

Male bud type: 1= Normal (present), 2= Degenerating before maturity (like false-horn ‘Plantain’), 3= Like true-horn ‘Plantain’ (absent)

Male bud shape: 1= Like a top, 2= Lanceolate, 3= Intermediate, 4= Ovoid, 5 = Rounded

Male bud size: Length and maximum diameter of male bud at harvest 1= ≤20 cm, 2= 21 to 30 cm, 3= ≥31 cm

Inflorescence Photographs

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

5. Bract

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Bract base shape									
Bract apex shape									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Bract scars on rachis									
Wax on bract									

Bract base shape: 1= Small shoulder, 2= Medium, 3= Large shoulder

Bract apex shape: 1= Pointed, 2= Slightly pointed, 3= Intermediate, 4= Obtuse, 5= Obtuse and split

Bract scars on rachis: Recorded on scars left after fall of bracts and flowers 1= Very prominent, 2= Not prominent

Wax on bract: Recorded on the external surface 1=Very little or no visible sign of wax, 2= Very few wax, 3= Moderately waxy, 4 = Very waxy

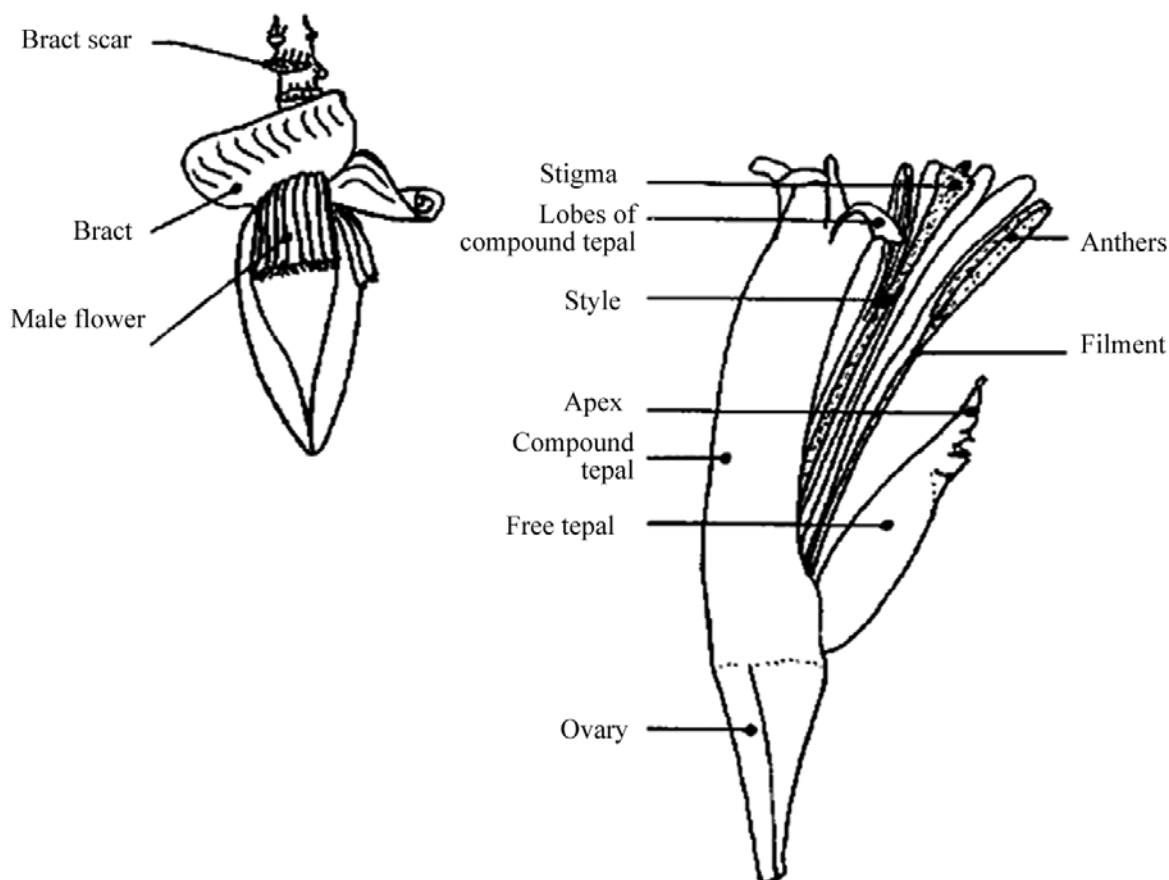


Figure 4 : Male bud and flower (adapted from Champion 1967)

6. Flower

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Male flower behavior									
Compound tepal colour									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Free tepal colour									
Free tepal shape									
Anther colour									
Pollen sac colour									
Style colour									
Style shape									
Stigma colour									
Ovary shape									
Ovary colour									

Male flower behavior: 1= Falling before the bract, 2= Falling with the bract, 3= Falling after the bract, 4 = Neutral/male flowers persistent

Compound tepal colour: 1= White, 2= Cream, 3= Yellow, 4= Orange, 5= Pink/pink-purple, 6= Other

Free tepal colour: 1= Translucent white, 2= Opaque white, 3= Tinted with yellow, 4= Tinted with pink

Free tepal shape: 1= Rectangular, 2= Oval, 3= Rounded, 4 = Fan-shaped

Anther colour: Observed on the face opposite to the dehiscence split of the anther (dorsal face). 1= White, 2= Cream, 3= Yellow, 4= Grey, 5=Brown/rusty brown, 6= Pink/pink-purple, 7= Black (anthers aborted), 8 =Other

Pollen sac colour: 1= White, 2= Cream, 3= Yellow, 4= Brown/rusty brown, 5= Pink/pink- purple, 6= Red-purple, 8 =Other

Style colour: 1= White, 2= Cream, 3= Red-purple, 4= other

Style shape: 1= Straight, 2= Curved under stigma, 3= Curved at the base, 4= Curved twice, 5= Other (specify in descriptor)

Stigma colour: 1= Cream, 2 = Yellow, 3= Pink/pink-purple, 4= Bright yellow, 5= Orange, 6= Other

Ovary shape: 1 Straight, 2 Arched

Ovary colour: 1= White, 2= Cream, 3 = Yellow, 4= Green, 5 Other

7. Fruit

For the following descriptors, records should be made on the inner fruit in the middle of the mid-hand of the bunch, at harvest time (first fruit ripening on bunch)

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Number of fruits									
Fruit length (cm)									
Fruit shape									
Transverse section of fruit									
Fruit apex									
Remain of flower relicts at fruit apex									
Immature fruit peel colour									
Mature fruit peel colour									
Fruit peel thickness (mm)									
Adherence of the fruit peel									
Pulp in fruit									
Pulp colour before maturity									
Pulp colour at maturity									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flesh texture									
Predominant taste									
Presence of seed									
Seed surface									
Seed shape									
Productivity (Kg/tree)									

- **Number of fruits:** Observed on the mid-hand of the bunch 1= ≤ 12 , 2= 13-16, 3= ≥ 17
- **Fruit length:** Measured as the internal arc of the fruit, without pedicel 1= ≤ 15 cm, 2 = 16- 20 cm, 3 = 21- 25 cm, 4 = 26- 30 cm, 5 = ≥ 31 cm
- **Fruit shape:** 1= Straight (or slightly curved), 2= Straight in the distal part, 3= Curved (sharp curve), 4= Curved in 'S' shape (double curvature), 5= Other
- **Transverse section of fruit:** Observed on mature fruit ('ready to eat' - ripe but not over-ripe, full yellow stage) 1= Pronounced ridges, 2= Slightly ridged, 3 = Rounded
- **Fruit apex:** Observed at the distal end of the fruit 1= Pointed, 2= Lengthily pointed, 3= Blunt-tipped, 4= Bottle-necked, 5= Rounded
- **Remain of flower relicts at fruit apex:** Observed at the distal end of the fruit. 1= Without any floral relicts, 2= Persistent style, 3= Base of the style prominent
- **Immature fruit peel colour:** Recorded on the youngest hand of the bunch, before maturity 1= Yellow, 2= Light green, 3= Green, 4 = Green and pink, red or purple, 5 =Silvery, 6= Dark green, 7= Brown/rusty brown, 8= Pink, red or purple, 9= Black, 10= Other
- **Mature fruit peel colour:** Recorded at fruit maturity (ripe, but not over-ripe; full yellow stage). 1= Yellow, 2= Bright yellow, 3= Orange, 4 = Grey spots, 5= Brown/rusty-brown, 6= Orange red, red or pink/pink purple, 7= Red-purple, 8= Black, 9= Other
- **Fruit peel thickness:** Recorded at fruit maturity ('ready to eat' ripe, but not over-ripe; full yellow stage) 1= Two or less, 2= Three or mor
- **Adherence of the fruit peel:** Recorded at fruit maturity (ripe, but not over-ripe; full yellow stage) 1= Fruit peels easily, 2= Fruit does not peel easily
- **Pulp in fruit:** 1= Without pulp, 2= With pulp
- **Pulp colour before maturity:** Recorded on youngest hand of the bunch. 1= White, 2= Cream, 3 =Ivory, 4 =Yellow, 5 =Orange, 6= Beige-pink, 7= Other
- **Pulp colour at maturity:** Ripe, but not over-ripe; full yellow stage 1= White, 2= Cream, 3= Ivory, 4= Yellow, 5= Orange, 6= Beige-pink, 7= Other
- **Flesh texture:** 1 Firm, 2 Soft
- **Predominant taste:** 1= Astringent (like cooking banana), 2= Mild, slightly tasty or tasteless, 3= Sweet (like

Cavendish), 4= Sugary (like 'Pisang Mas'), 5= Sweet and acidic (apple like), 6= Other

- **Presence of seed:** 1= <5, 2= 5-20, 3=>20
- **Seed surface:** 1= Smooth, 2= Wrinkled
- **Seed shape:** 1= Flat, 2= Angular (more or less pyramidal), 3= Globular (spherical), 4= Rounded

Sample fruit photographs (Please follow the instructions from the descriptor)

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

Photographs of fruit hanging on the tree (Please follow the instructions from the descriptor)

Sample 1 Photo	Sample 2 Photo
----------------	----------------

Sample 3 Photo	Sample 4 Photo
----------------	----------------

8. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Low Temperature									
Mineral deficiencies									
Flooding									
Soil acidity									
Winds									
Manganese toxicity									
Drought									
High Temperature									

*These are coded in a susceptibility scale of 1-9 viz,:

- 1-Very low or no visible sign of susceptibility
- 3- Low
- 5-Medium
- 7-High
- 9- Very High

9. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Example : Moko Disease	3	2	8	6	
1	Yellow sigatoka					

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
Example : Moko Disease		3	2	8	6	
2	Bunchy Top					
3	Anthraxnose					
4	Black sigatoka					
5	Panama disease/Fusarium wilt					
6	Moko disease					
7	Weevil borer					
8	Root lesion nematode					
9	Burrowing nematode					
10	Scaring beetle					

*Disease and pests should be scored in 1-9 scale where;

1-Very low or no visible sign of susceptibility 3- Low

5-Medium 7-High

9- Very High

Please refer the descriptor for more clarity on rating.

10. Evaluation descriptor

Observations should be made at harvest, when the first ripe fruit develops on the bunch. Record mean and standard deviation.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Planting to shooting (d)									
Plant crop cycle [d]									
Ratoon crop cycle 2 [d]									
Pseudostem height [cm]									
Pseudostem girth [cm]									
Height of following ratoon [cm]									
Bunch weight [kg]									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Number of hands									
Number of fruits									
Fruit length [cm]									
Fruit diameter [mm]									
Fruit weight [g]									
Number of living (functional) leaves at flowering									
Number of living (functional) leaves at harvest									

Planting to shooting : From planting until the emergence of the first bract

Plant crop cycle: From planting to harvest

Ratoon crop cycle 2: Number of days between two successive harvests

Pseudostem height: From base of pseudostem to the point of bunch emergence

Pseudostem girth: Measured at 1 m from base of pseudostem

Height of following ratoon: Measured from base of pseudostem to last leaf axil

Bunch weight: Bunch stalk (peduncle) is cut above the first hand at the level of the last scar and immediately below the last hand

Fruit length : Recorded on the central external fruit of the middle hand

Fruit diameter: Recorded on the central external fruit of the middle hand

Fruit weight: Average: divide the collective weight of the hands (cut from the peduncle) by the number of fruits.

NOTES:

Please specify any additional information to be recorded regarding the accession which are not covered and stated as "Other" in above parameters.

Citrus (*Citrus spp.*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI, 1999. Descriptors for Citrus. International Plant Genetic Resources Institute, Rome, Italy)



National Center for Fruit Development (NCFD)

Kirtipur, Kathmandu, Nepal, Tel./Fax: 977-1-5905053

Email: ncfd.gov.np@gmail.com,

Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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 ungraded 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 is used;
- (e) many quantitative characters which are continuously variable are recorded on a 1-9 scale,

where: 1-Very low, 2-Very low to low, 3-Low, 4-Low to intermediate, 5-Intermediate, 6-Intermediate to high, 7-High, 8-High to very high, 9-Very high is the expression of a character.

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 susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;

- (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; (ii) a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

- 1 Toothed
- 2 Elliptic
- 3 Linear

- (g) absence/presence of characters is scored as in the following example: Terminal leaflet 0 Absent 1 Present
- (h) blanks are used for information not yet available;
- (i) for accessions which 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 can be utilized, such as Rana et al. (1991) or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;
- (j) 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.

Information of Origin and Parentage (Collecting Descriptor)

1. Collector's Number:
(Passport data is prerequisite for this number-given by Gene-Bank)
2. Collecting Institute:
(Institute or person collecting/sponsoring the original sample)
3. Date of collection of original sample (Month/Year):
4. Country of collection or country where cultivar/variety bred:
5. Province/State from where sample is collected:
6. Location of collection site:
(Kilometers and direction from nearest town/village/landmark)
7. Latitude of collection site:
(Degrees and minutes followed by N (north) or S (south), e.g. 1030S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 7625W)
9. Altitude of collection site:
(Elevation above sea level in meters)
10. Collection source:
(1-Wild, 2-Farm land, 3-Farm store, 4-Backyard, 5-Village market, 6-Commercial market, 7-Institute, 8-Other, Specify in Notes)
11. Status of sample:
(1-Wild, 2-Weedy, 3-Breeder's line, 4-Primitive cultivar / landrace, 5-Advanced cultivar (bred), 6- Other, specify in Notes)
12. Local Name:
(Name given by farmer to cultivar/landrace/weed)
13. Types of sample:
(1-Vegetative, 2-Seed 3-Both)
14. Nature of vegetative sample:
(0-Not vegetative (seed) 1-Cuttings - for grafting, 2-Cuttings - for rooting, 3-Rooted plants, 4-Tissue culture, 5-Other, specify in Notes))
15. Seasonality:
(1-Available only in season/at particular period, 2-Available throughout the year)
16. Virus disease status (Including mycoplasma) :
(1-Virus disease free**, 2-Virus disease tested (infected)**, 3-Not tested **
Record results of virus tests in the NOTES (positive or negative))
17. End Use:
(1-Scion cultivar - dessert, 2-Scion cultivar - processing, 3-Dual or multipurpose consumption, 4- Clonal rootstock, 5-Clonal interstock, 6-Seedling rootstock, 7-Ornamental/pollinator (pollinizer), 8-Botanical (wild) species, 9-Other (specify in the NOTES))

Environment and Site Information (Characterization and evaluation site descriptors)

- Country of characterization and/or evaluation:
- Site (research institute/farm center/farm):
 - Name of farm or institute:
 - Latitude:
 - Longitude:
 - Elevation: (masl)
 - Slope: (degree)
 - Slope aspect: (ex-NE, SW, etc)
- Evaluator's name and address:
- Evaluation Year: (Starting date :MM/YYYY)
- Planting Date: (YYYYMMDD)
- Harvest Date: (YYYYMMDD)
- Evaluation Environment:
 (Environment in which characterization/evaluation was carried out: 1-Field 2-Screenhouse 3- Greenhouse 4-Laboratory 99-Other (specify in descriptor Notes))
- Climate of the site:
 - Temperature (degree celcius):
 Max Min Mean
 (Seasonal maximum, minimum and mean temperature)
 - Rainfall (mm):
 (Annual average, state number of recorded years)
 - Dry season length (days):
 - Wind (Km s-1):
 (Annual maximum wind velocity)
 - Frost:
 Duration of temperature below freezing: days
 Date of most recent frost: (DDMMYYYY)
 - Relative humidity:
 Diurnal range: %
 Seasonal range: %
 Light: (Shady or Sunny)
 - Daylength (h):
 (Provide either the monthly (mean, maximum, minimum) or the seasonal (mean, maximum, minimum))

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. All observations should be made on plants of the same age (not less than 3 years old). Please refer the Citrus Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np.

1. Vegetative

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Rootstock									
Ratio of Trunk: Rootstock Diameter*									
Scion-Trunk Surface									
Tree Shape**									
Tree growth habit***									
Density of branches									
Branch angle^									
Spine density on adult tree (not on suckers)									
Spine length on adult tree (not on suckers)^^									
Spine shape									
Shoot tip colour									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Shoot tip surface									

*Recorded at 20 cm above and under grafting line

**Recorded in the natural state. See Figure.

***Recorded in the natural state, immediately after harvest

^ Attachment to main trunk

^^Average of 10 spines at leaf axil

Tree Photographs:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

2. Leaf

Use 30 mature leaves per adult tree unless otherwise indicated.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Vegetative life cycle									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf division									
Intensity of green colour of leaf blade*									
Leaf colour variegation									
Leaf lamina attachment**									
Leaf lamina length [mm]***									
Leaf lamina width [mm]^									
Ratio leaf lamina length/width									
Leaf thickness [mm]^^									
Leaf lamina shape									
Leaf lamina margin									
Leaf apex									
Absence/ presence of petiole wings									
Petiole wing width*									
Petiole wing shape									
Junction between petiole and lamina									

*Recorded on fully developed leaves

**Length of petiole relative to length of leaf lamina. See Figure.

*** Recorded from petiole base to lamina tip. 10 fully developed leaves taken from adult trees (not taken from suckers). Use apical leaflet in the case of compound leaf.

^Recorded at the widest point. 10 fully developed leaves taken from adult trees. Use apical leaflet in the case of compound leaf.

^^ Recorded at the thickest point. 10 fully developed leaves taken from adult trees. Use apical leaflet in the case of compound leaf.

3. Flower

Data recorded from ten flowers or inflorescences per tree. Recorded at full flowering. See Figure.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Pedicel length [mm]									
Calyx diameter									
Length of anthers relative to stigma									
Flower type									
Colour of open flower									
Colour of anthers									
Number of petals per flower									
Petal length [mm]									
Petal width [mm]									
Number of stamens									
Viable pollen*									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flowering month									
Latitude**									
Start date of flowering season [YYYYMMDD]									
End date of flowering season [YYYYMMDD]									

*Visual observation, in vitro after Alexander dying

**Degrees and minutes followed by N (North) or S (South) (e.g. 1030S). Missing data (minutes) should be indicated with hyphen (e.g. 10—S).

4. Fruit

All observations on the fruit should be made at the stage of optimum ripeness (ratio total soluble solids/acid content of juice). Data observed on 10 typical fruits per tree replicated three times.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruiting season*									
Start of fruiting season [YYYYMMDD]									
End of fruiting season [YYYYMMDD]									
Fruit weight [g]**									
Fruit diameter [mm]**									
Fruit length [mm]**									
Fruit shape									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Shape of fruit base (See stalk end)									
Shape of fruit apex (See stylar end)									
Fruit skin (epicarp) colour***									
Width of epicarp at equatorial area [mm]									
Fruit surface texture									
Adherence of albedo (mesocarp) to pulp (endocarp)									
Nature (conspicuousness) of oil glands									
Fruit rind (mesocarp) thickness [mm]^									
Albedo colour									
Absence/presence of areola									
Areola diameter [mm]									
Fruit stylar end^^									
Fruit attachment to stalk									
Productivity (Kg/tree)									

*Compared with some common standard midseason variety for each family of Citrus (orange, lemon, etc.)

**Record the average

***Observe the main colour

^Measured in the equatorial area. See Figure.

^^Observe fruits that ripened on the tree.

Sample fruit photographs

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

5. Segments

Well-developed segments observed on 10 fruits taken from adult trees.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Number of segments per fruit									
Adherence of segment walls to each other									
Segment shape uniformity									
Thickness of segment walls*									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruit axis									
Cross-section shape of axis									
Diameter of fruit axis [mm]									

*Nature of segment membrane

6. Pulp

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Pulp (flesh) colour									
Pulp colour intensity									
Pulp colour uniformity									
Pulp firmness									
Pulp texture									
Vesicle length*									
Vesicle thickness									
Juice content in endocarp**									
TSS (⁰ Brix)									
Total titratable acid (%)									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
TSS:TA ratio									

*Indicate location of determination (stem end, stylar end or centre of segment), in descriptor Notes.

**Quantity related to total fruit weight

7. Seed

Fully developed seeds extracted from 10 full ripe fruits (unless otherwise specified), taken from trees randomly selected in solid blocks.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Average
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Average number of seeds per fruit*									
Seedless test**									
Seed shape***									
Seed surface***									
Seed colour [^]									
Cotyledon colour									
Seed embryony ^{^^}									
Seed length (mm) ^{^^^}									
Seed width (mm) ^{^^^}									
Seed weight (gm) ^{^^^}									

*Observe only fully developed seeds taken on trees in open pollination

**Number of seeds present in fruits under self-pollination conditions (solid blocks)

***Observed on 20 seeds.

^Observed on 20 fresh seeds. Visual observation through the seed testa

^^Number of embryos per seed observed using a stereoscope. Average number of 30 seeds.

^^^ Average of 20 seeds.

8. Evaluation descriptor

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree age (Y)									
Scion-rootstock compatibility									
Tree vigour									
Tree height									
Canopy diameter									
Arrangement of flowers									
Inflorescence position									
Inflorescence type									
Flowering regularity									
Flowering abundance									
Secondary flowering									
Fruit bearing cycle									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruit bearing habit									
Yield behaviour									
Alternation									
Yield efficiency									

9. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Low temperature									
High temperature									
Drought									
Wet soil									
Salinity									
Soil alkalinity									
Frost									
Constant winds									

*These are coded in a susceptibility scale of 1-9 viz.: 1-Very low or no visible sign of susceptibility, 3- Low, 5-Medium, 7-High, 9- Very High

10. Disease and Pests

S. N.	Disease and Pest	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
Example : Canker		3	2	8	6	
1	CTV					
2	Canker					
3	Mold/Rot/ Gummosis (Fungi)					
4	Scale					
5	Mealybugs					
6	Aphids					
7	Whiteflies					
8	Psyllids					
9	Fruitflies					
10	Leaf Hoppers					
11	Thrips					
12	Mites					
13	Leaf Miner					
14	Nematodes					

*Disease and pests should be scored in 1-9 scale where; 1-Very low or no visible sign of susceptibility, 3-Low, 5-Intermediate, 7-High, 9-Very high. Please refer the descriptor for more clarity on rating.

NOTES:

Please specify any additional information to be recorded regarding the accession which are not covered and stated as "Other" in above parameters.

Avocado (*Persea spp.*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI. 1995. Descriptors for Avocado (*Persea Spp.*). International Plant Genetic Resources Institute, Rome, Italy)



National Center for Fruit Development (NCFD)

Kirtipur, Kathmandu, Nepal, Tel./Fax: 977-1-5905053

Email: ncfd.gov.np@gmail.com,

Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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- (a) the Système International d'Unités (SI) is used;
- (b) the units to be applied are given in square brackets following the descriptor name;
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- (d) the three-letter abbreviations from the International Standard (ISO) Codes for the representation of names of countries is used;
- (e) many quantitative characters which are continuously variable are recorded on a 1-9 scale, where: 1-Very low, 2-Very low to low, 3-Low, 4-Low to intermediate, 5-Intermediate, 6-Intermediate to high, 7-High, 8-High to very high, 9-Very high is the expression of a character.
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 susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;
- (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; (ii) a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

- 1 Toothed
 - 2 Elliptic
 - 3 Linear
- (g) absence/presence of characters is scored as in the following example: Terminal leaflet 0 Absent 1 Present
 - (h) blanks are used for information not yet available;
 - (i) for accessions which 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 can be utilized, such as Rana et al. (1991) or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;
 - (j) 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.

Information of Origin and Parentage (Collecting Descriptor)

1. Collector's Number:
(Passport data is prerequisite for this number-given by Gene-Bank)
2. Collecting Institute:
(Institute or person collecting/sponsoring the original sample)
3. Date of collection of original sample (Day/Month/Year):
4. Country of collection or country where cultivar/variety breeding:
5. Province/State from where sample is collected:
6. Location of collection site:
(Kilometers and direction from nearest town/village/landmark)
7. Latitude of collection site:
(Degrees and minutes followed by N (north) or S (south), e.g. 1030S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 7625W)
9. Altitude of collection site:
(Elevation above sea level in meters)
10. Collection source:
(1-Wild, 2-Farm land, 3-Farm store, 4-Backyard, 5-Village market, 6-Commercial market, 7-Institute, 8-Other, Specify in Notes)
11. Status of sample:
(1-Wild, 2-Weedy, 3-Breeder's line, 4-Primitive cultivar / landrace, 5-Advanced cultivar (bred), 6- Other, specify in Notes)
12. Local Name:
(Name given by farmer to cultivar/landrace/weed)
13. Types of sample:
(1-Vegetative 2-Seed 3-Pollen 4-Tissue culture)
14. Plant Population Density:
(3-Low 5-Intermediate 7-High)
15. Prevailing Stresses:
(Information on main associated biotic (pests and diseases) and abiotic (drought) stresses)
16. Genetic Erosion:
(Estimate the rate of genetic erosion of the species occurring in the region of collection; 3-Slow, 5-Intermediate, 7-High)
17. End Use:
(1-Vegetable, 2-Food, 3-Spice, 4-Vitamin, 5-Oil 6-Medicinal, 7-Ornamental, 8-Timber, 9-Other (Specify))

Environment and Site Information (Characterization and evaluation site descriptors)

- Country of characterization and/or evaluation:
- Site (research institute/farm center/farm):
 - Name of farm or institute:
 - Latitude:
 - Longitude:
 - Elevation:..... (masl)
 - Slope: (degree)
 - Slope aspect: (ex-NE, SW, etc)
- Evaluator's name and address:
- Evaluation Year: (Starting date :MM/YYYY)
- Evaluation environment:
(Environment in which characterization/evaluation was carried out; 1-Field 2-Screen house 3- Glasshouse 4-Laboratory 5-Other (specify in descriptor Notes))
 - Sowing/grafting date:[YYYYMMDD].
 - Harvest date: [YYYYMMDD].
 - Seed germination [%]: (Specify number of days over which germination is measured)
 - Grafting/budding/layering/stooling success percentage:
Specify number of days over which the success is recorded. Indicate the rootstock
- Field Spacing: R-R, P-P
- Fertilizer:
Specify types used, doses, frequency of each and method of application
- Plant protection:
Specify pesticides used, doses, frequency of each and method of application
- Climate of the site:
 - Temperature (degree celcius):
Max Min Mean
(Seaonal maximum, minimum and mean temperature)
 - Rainfall (mm):
(Annual average, state number of recorded years)
 - Wind (Km s-1):
(Annual maximum wind velocity)
 - Frost:
Duration of temperature below freezing: days
Date of most recent frost: (DDMMYYYY)
 - Relative humidity:
Diurnal range: %
Seasonal range: %
 - Light: (Shady or Sunny)

Plant descriptors

During characterization and evaluation of the genetic resources, five plants should be sampled per accession. Please refer the Avocado Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np.

1. Overall Tree

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Tree age (y)										
Tree type										
Tree vigour										
Tree spread (m)										
Tree height (m)										
Tree shape										
Trunk Surface										
Trunk circumference (cm)										
Distribution of Branches										
Branching Pattern										

- **Tree Type:** (1-Seedling, 2-Grafted, 3-Clonal)
- **Tree Vigor:** (7- Strong, 5- Intermediate, 3-Weak)
- **Tree spread (m):** Measured as the mean diameter using two directions
- **Tree height (m):** from ground level to the top of the tree
- **Tree Shape:** 1-Columnar, 2-Pyramidal, 3-Obovate, 4–Rectangular, 5- Circular, 6-Semicircular, 7-semielliptic, 8-irregular, 9 - Other (specify)
- **Trunk Surface:** 3-Smooth, Rough-5, Very rough-7

- **Distribution of branches:** 1- Ascendant, 2- Irregular, 3-Verticillate, 4- Axial, 5-Horizontal
- **Trunk circumference (cm):** Recorded at 30 cm above ground level
- **Branching pattern:**
 - 1- Extensive (one branch arises below apex of twig with each flush of growth)
 - 2- Intensive (several branches arise below apex of twig with each flush of growth)
 - 3- Both patterns (record prominent one)

Tree Photographs

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Colour of young twig										
Surface of young twig										
Colour of lenticels of young twig										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Leaf Shape										
Leaf base shape										
Leaf blade length (cm)										
Pubescence of leaf under surface										
Pubescence of leaf upper surface										
Colour of mature leaves										
Leaf margin										
Number of primary veins										
Relief of venation on upper surface										
Leaf apex shape										
Leaf texture										

- **Colour of young twig (Including young leaves of the shoot tip):** 1 – Yellow, 2- Green, Red (greyed-orange group), Other (specify)
- **Surface of young twig:** 1- Glabrous, 2- Pubescent
- **Colour of lenticels of young twig:** 1- Ivory, 2-Green, 3-Brown, 4-Red, 5-Purple, 6-Other (specify)
- **Leaf shape (Record on midspring flush leaf):** 1-Ovate, 2-Narrowly obovate, 3-Obovate, 4-Oval, 5-Roundish, 6-Cordiform, 7-Lanceolate, 8-Oblong, 9-Oblong-lanceolate, 10-Other (specify)
- **Leaf base shape:** 1-Acute, 2-Obtuse, 3-Truncate
- Leaf blade length [cm] (Average of 10 mature leaves)
- **Pubescence of leaf under surface:** 3-Sparse, 5-Intermediate, 7-Dense
- **Pubescence of leaf upper surface:** 3-Sparse, 5-Intermediate, 7-Dense

- **Colour of mature leaves:** 1-Light green, 2-Green, 3-Dark green
- **Leaf margin:** 1-Entire, 2-Undulate
- **Relief of venation on upper surface:** 3-Sunken, 5-Intermediate, 7-Raised
- **Leaf apex shape:** 1-Very acute, 3-Acute, 5-Intermediate, 7-Obtuse, 9-Very obtuse
- **Leaf texture:** 3-Soft, 5-Semihard, 7-Hard, 9-Veryhard

2. Flowers

Observations should be made in at least 5 flowers for each tree.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
No. of years to flowering after planting (y)										
First sign of flower buds										
First flowers open										
End of flowering										
Secondary flowering										
Leaf defoliation										
Flowering type										
Flower colour										
Inflorescence position										
Absence/ presence of pollen										
Petal Pubescence										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Sepal Pubescence										
No.of flowers per inflorescence										
No. of inflorescence ramification										
Length of inflorescence main axis										
Pedicel length (mm)										
Petal length (mm)										
Sepal length (mm)										
Flower style										
Absence/ presence of nectary stalks										

- **Season of flowering and duration:** First sign of flower buds, First flowers open, End of flowering DD/MM/YYYY (If possible, indicate the flowering season of a known cultivar)
- **Secondary flowering:** (0-Absent, 1-Present)
- Leaf defoliation (Recorded while flowering): 3-Partial, 9-Full
- **Flowering type (Recorded after five observations):** 1-Type A (A.M.:Pistillate stage - Functionally female, P.M.:Staminate stage Functionally male), 2-Type B (P.M.:Pistillate stage - Functionally female, A.M.:Staminate stage Functionally male), 3-Unknown
- **Inflorescence position:** 1-Terminal, 2-Subterminal, 3-Axillary, 4 Other (specify)
- **Flower colour :** 1-Cream, 2-Yellow, 3-Green, 4-Brown, 5-Reddish, 6-Other (specify)
- **Absence/presence of pollen:** 0-Absent, 1-Present
- **Petal/Sepal Pubescence:** Specify if it is observed in inner or outer parts. (3-Sparse, 5-Intermediate, 7-Dense)
- **Flower style:** 1-Straight 2-Kinked 3-Other

Flower Photographs:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

3. Fruits

Observations should be made on 5 fruits per tree.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
No. of years to first fruiting after planting (y)										
No. of days from flowering to fruit maturity (d)										
Season of fruiting										
Starting date (DDMMYYYY)										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Ending date (DDMMYYYY)										
Fruiting habit										
Fruit shape										
Fruit length (cm)										
Fruit diameter (cm)										
Individual fruit weight (g)										
Fruit size uniformity										
Fruit base shape										
Fruit apex shape										
Fruit apex position										
Ridges on fruit										
Gloss of fruit skin										
Pedicle position on fruit										
Nailhead pedicel apex shape										
Peduncle length (cm)										
Peduncle diameter (mm)										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Fruit skin surface										
Ripe fruit skin colour										
Fruit skin thickness										
Pliability of fruit skin										
Adherence of skin to flesh										
Colour of flesh next to skin										
Colour of flesh next to seed										
Flesh texture										
Sweetness of flesh										
Bitterness of flesh										
Nut taste of flesh										
Fiber in flesh										
General taste of flesh										
Degree of discoloration of open fruit after 4 hour										
Colour of discoloration of flesh										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Storage days of fruit (d)										
Self life of fruit (d)										
Yield per tree (kg/y)										
Yield behavior										

- **Season of fruiting:** Starting and end date (If possible, indicate the fruiting season of a known cultivar)
- **Fruiting habit (Specify number of trees evaluated per accession):** 1-Single isolated fruit, 2-Clusters
- **Fruit shape (Specify number of fruits evaluated):** 1-Oblate, 2-Spheroid, 3-High spheroid, 4-Ellipsoid, 5-Narrowly, 6- Obovate, 7-Pyriform, 8-Clavate, 9-Rhomboidal, 10-Other (specify)
- **Fruit length [cm]/ Weight(gm):** Average of five fruits
- **Fruit diameter [cm]:** Measured at the broadest part. Average of five fruits
- **Fruit size uniformity:** 3-Low, 5-Intermediate, 7-High
- **Fruit base shape:** 1- Depressed, 2- Flattened, 3-Inflated, 4- Pointed
- **Fruit apex shape:** 1- Deeply Depressed, 2- Slightly Depressed, 3-Flattened, 4- Rounded, 5-Pointed
- **Fruit apex position:** 1-Central, 2 Asymmetric
- **Ridges on fruit:** 1-None (Absent), 2-Partial, 3-Entire
- **Gloss of fruit skin:** 3-Weak, 5-Medium, 7-Strong
- **Pedicle position on fruit:** 1-Central, 2-Asymmetrical, 3-Very asymmetrical, 4-Extremely asymmetrical
- **Pedicle shape:** 1-Cylindrical, 2-Conical, 3-Rounded, 4-Other (specify)
- **Nailhead pedicle apex shape:** 0-Absent, 1-Present
- **Peduncle length [cm] /Peduncle diameter [mm]** (five observations per accession should be taken and diameter recorded at the middle part)
- **Fruit skin surface:** 3-Smooth, 5-Intermediate, 7-Rough
- **Ripe fruit skin colour:** 1-Light green, 2-Green, 3-Dark Green, 4-Yellow, 5-Red, 6-Purple, 7-Black, 8-Speckled, 9-other (specify)
- **Fruit skin thickness (Average of five observations per accession):** 3-1 mm, 5-2mm, 7-3mm
- **Pliability of fruit skin:** 1-Pliable, 2-Brittle
- **Adherence of skin to flesh:** 3-Slight 5-Intermediate 7-Strong
- **Colour of flesh next to skin (Average of five ripe fruits):** 1-Ivory, 2-Light yellow, 3-Yellow, 4-Deep Yellow, 5-Light green, 6-Green, 7-Other (specify)
- **Colour of flesh next to seed:** 1-Ivory, 2-Light yellow, 3-Yellow, 4-Deep Yellow, 5-Light Green, 6-Green, 7-Other(Specify)
- **Flesh texture:** 1-Watery 2-Buttery 3- Pastose (doughy) 4-Granular 5-Other
- **Sweetness of flesh:** 1-Low, 2-Intermediate, 3-High
- **Bitterness of flesh:** 3-Low, 5-Intermediate, 7-High
- **Nut taste of flesh:** 3-Low, 5-Intermediate, 7-High
- **Fibre in flesh (Presence of fibre in tasted flesh of ripe fruits):** 3-Low, 5-Intermediate, 7-High
- **General taste of flesh:** 1-Verypoor, 2-Poor, 3-Fair, 4-Good, 5-Excellent

- **Degree of discolouration of open fruit after 4 hour:** 3-Low, 5-Intermediate, 7-High,
- **Colour of discolouration of flesh:** 1-Blue, 2-Brown, 3-Grey, 4-Black
- **Storage days of fruit [d]** (Number of days to softening (ripening) at room temperature (20°C))
- **Shelf life of fruit [d]** (Number of days ripe fruit keeps at room temperature (20°C))
- **Yield per tree(kg/Y):** Average of eight trees per accession
- **Yield Behavior(Average of eight trees per accession):** 1-Continuous, 2-Alternate, 3-Eratic

Photographs of fruit hanging on the tree:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

Photographs of picked fruit samples:

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
----------------	----------------

4. Seed

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Seed shape										
Seed weight (g)										
Cotyledon surface										
Attachment of cotyledons										
Cotyledon colour										
Length of seed cavity (cm)										
Diameter of seed cavity (cm)										
Length of seed (cm)										
Diameter of seed (cm)										
Seed coat (Ripe fruit)										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Seed position in fruit										
Shape of seed cross section	1	Circular	1		1		1			

- **Seed shape:** 1-Oblate, 2-Spheroid, 3-Ellipsoid, 4-Ovate, 5-Broadly ovate, 6-Cordiform, 7-Base flattened, apex rounded, 8-Base flattened, apex conical, 9-Other (specify)
- **Cotyledon surface:** 3-Smooth, 5-Intermediate, 7-Rough
- **Attachment of cotyledons:** 0-Not attached, 1-Attached
- **Cotyledon colour:** 1-Ivory, 2-Cream, 3-Yellow, 4-Pink, 5-Other (specify)
- **Length of seed cavity [cm]:** Average of five fruits per accession
- **Diameter of seed cavity [cm]:** Average of five fruits per accession
- **Length of seed [cm]:** Average of five fruits per accession
- **Diameter of seed [cm]:** Average of five fruits per accession
- **Seed coat:** 1-Seed not free, coat not attached to the flesh, 2-Seed not free, coat attached to the flesh, 3-Seed free, coat not attached to the flesh, 4-Seed free, coat attached to the flesh
- **Seed position in fruit:** 1-Basal, 2-Central, 3-To one side, 4-Apical
- **Shape of seed cross-section:** 1-Circular, 2-Elliptical

Photographs of seed:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

Photographs of cross section of seed:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

5. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Low Temperature										
High Temperature										
Water Logging										
Drought										
Heavy and compact soil (Limited aeration)										
Iron Chlorosis										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Saline Soil										
Alkaline Soil										
Saline water										
Winds										

*These are coded in a susceptibility scale of 1-9 viz,:

1- Very low or no visible sign of susceptibility

3- Low

5-Medium

7-High

9- Very High

6. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Example : Fruit Scab		3	2	8	6	1
1	Red mite					
2	Thrips					
3	Leaf gall					
4	Seed weevil					
5	Branch weevil (Borer)					
6	Root rot					
7	Fruit scab					
8	Anthraxnose					
9	Wilt (die back)					
10	Bacterial Fruit Blast					
11	Foot rot					
12	Trunk Canker					
13	Stem End Rot					

In each sample, it is important to indicate the age of plant when damage is observed. These are coded on a susceptibility scale from 1 to 9: 1-Very low or no visible sign of susceptibility, 3-Low, 5-Intermediate, 7- High, 9-Very high.

NOTES:

Please specify any additional information to be recorded regarding the accession which are not covered and stated as "Other" in above parameters.

Litchi (*Litchi chinensis*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI. 2002. Descriptors for Litchi (*Litchi chinensis*). International Plant Genetic Resources Institute, Rome, Italy)



National Center for Fruit Development (NCFD)

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Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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 ungraded 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 is used;
- (e) many quantitative characters which are continuously variable are recorded on a 1-9 scale,

where: 1-Very low, 2-Very low to low, 3-Low, 4-Low to intermediate, 5-Intermediate, 6-Intermediate to high, 7-High, 8-High to very high, 9-Very high is the expression of a character.

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 susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;

- (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; (ii) a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

- 1 Toothed
- 2 Elliptic
- 3 Linear

- (g) absence/presence of characters is scored as in the following example: Terminal leaflet 0 Absent 1 Present
- (h) blanks are used for information not yet available;
- (i) for accessions which 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 can be utilized, such as Rana et al. (1991) or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;
- (j) 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.

For the observations on the fruit, 10 typical fruits should be selected out of a minimum of 20 from each trees. The terminal fruits should be excluded. The fruits should be examined at peak maturity, if necessary, after storage in air at the optimum commercial temperature.

Information of Origin and Parentage (Collecting Descriptor)

1. Collector's Number:
(Passport data is prerequisite for this number-given by Gene-Bank)
2. Collecting Institute:
(Institute or person collecting/sponsoring the original sample)
3. Date of collection of original sample (Month/Year):
4. Country of collection or country where cultivar/variety bred:
5. Province/State from where sample is collected:
6. Location of collection site:
(Kilometers and direction from nearest town/village/landmark)
7. Latitude of collection site:
(Degrees and minutes followed by N (north) or S (south), e.g. 1030S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 7625W)
9. Altitude of collection site:
(Elevation above sea level in meters)
10. Collection source:
(1-Wild, 2-Farm land, 3-Farm store, 4-Backyard, 5-Village market, 6-Commercial market, 7-Institute, 8-Other, Specify in Notes)
11. Status of sample:
(1-Wild, 2-Weedy, 3-Breeder's line, 4-Primitive cultivar / landrace, 5-Advanced cultivar (bred), 6- Other, specify in Notes)
12. Local Name:
(Name given by farmer to cultivar/landrace/weed)
13. Types of sample:
(1-Vegetative/budsticks, 2-Seed/seedling, 3-Fruit, 4-Pollen, 5-Tissue culture (specify which part of the plant is used in descriptor notes), 99-Other (specify which part of the plant is used in descriptor notes))
14. Prevailing Stresses:
(Information on main associated biotic (pests and diseases) and abiotic (drought) stresses)
15. Seasonality:
(1-Available only in season/at particular period, 2-Available throughout the year)
16. Genetic Erosion:
(Estimate the rate of genetic erosion of the species occurring in the region of collection; 1-Slow, 2-Moderate, 3-High, 4-Very high)
17. End Use:
(1-Scion cultivar - dessert, 2-Scion cultivar - processing, 3-Dual or multipurpose consumption, 4- Clonal rootstock, 5-Clonal interstock, 6-Seedling rootstock, 7-Ornamental/pollinator (pollinizer), 8-Botanical (wild) species, 9-Other (specify in the NOTES))

Environment and Site Information (Characterization and evaluation site descriptors)

- Country of characterization and/or evaluation:
- Site (research institute/farm center/farm):
 - Name of farm or institute:
 - Latitude:
 - Longitude:
 - Elevation: (masl)
 - Slope: (degree)
 - Slope aspect: (ex-NE, SW, etc)
- Evaluator's name and address:
- Evaluation Year: (Starting date :MM/YYYY)
- Evaluation environment:
 Environment in which characterization/evaluation was carried out; 1-Field, 2-Screen house, 3- Glasshouse, 4-Laboratory, 5-Other (specify in descriptor Notes)
- Sowing/grafting/budding/layering stooling date: [YYYYMMDD].
- Condition of the tree:
 (1-Dying, 2-Old declining, 3-Mature diseased, 4-Mature non-vigorous, 5-Mature vigorous, 6-Young (not yet bearing), 7-Healthy cropping poorly, 8-Healthy cropping well)
- Seed germination [%]: (Specify number of days over which germination is measured)
- Grafting/budding/layering/stooling success percentage:
 (Specify number of days over which the success is recorded. Indicate the rootstock)
- Field Spacing: R-R, P-P
- Fertilizer:
 (Specify types used, doses, frequency of each and method of application)
- Plant protection:
 (Specify pesticides used, doses, frequency of each and method of application)
- Climate of the site:
 - Temperature (degree celcius):
 Max Min Mean
 (Seasonal maximum, minimum and mean temperature)
 - Rainfall (mm):
 (Annual average, state number of recorded years)
 - Wind (Km s-1):
 (Annual maximum wind velocity)
 - Frost:
 Duration of temperature below freezing: days
 Date of most recent frost: (DDMMYYYY)
 - Relative humidity:
 Diurnal range: %
 Seasonal range: %
 - Light: (Shady or Sunny)
 - Daylength :(hr)
 (Provide either the monthly (mean, maximum, minimum) or the seasonal (mean, maximum, minimum))

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Average of at least three on-years (production years) data recorded on twelve trees, unless otherwise stated. Please refer the Litchi Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np.

1. Tree

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree age (year)									
Tree vigour									
Tree height (m)*									
Trunk Circumference (cm)**									
Trunk surface									
Crown Diameter (m)***									
Tree Volume (m ³) [^]									
Crown Shape									
Tree growth habit									
Branching Density									
Branching Pattern									
Young shoot Pubescence									

*From ground level to the top of the tree (if grafted, record also height of graft union and rootstock name). Evaluate only unpruned trees

**Recorded at 50 cm above ground level for trees raised through seedlings/ air layering/grafting.

***Measured as the mean diameter using two directions (North-South and EastWest).

^Calculated with the use of formula $\frac{4}{3} \pi a^2 b$ (where a = half of the spread, b= half of the height)

Tree Photographs:

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

2. Leaf

Average of 5 fully expanded representative leaves, collected from four trees when shoots are lignified. Do not select leaves that are abnormal due to the disease, nutritional imbalances and excessive vigour. For qualitative characteristics, indicate the predominant one.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Young leaf color*									
Mature leaf colour**									
Number of leaflets per leaf***									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Arrangement of leaflets (Phyllotaxy)									
Rachis length [mm]^									
Length of petiole (leaflet stalk) [mm]^^									
Leaflet blade length [cm]^^^									
Leaflet blade width [cm]^+									
Leaflet blade shape									
Leaflet apex shape									
Leaflet base shape									
Leaflet upper surface pubescence									
Leaflet lower surface pubescence									
Leaflet midrib appearance									
Leaflet venation appearance									
Leaflet curvature									
Date of initiation of new flushes [YYYYMMDD]^^									
Protuberances on petiole									

*Evaluated newly emerged leaf at fully expanded stage

**Evaluated at adaxial side, at fully mature stage

***Average number of leaflets from 10 leaves to be recorded

^ To be recorded from stem to the last leaflet

^^ To be recorded from the rachis to the base of the leaflet blade

^^^ Measured from the base to the tip of the leaf blade

+ Measured at the widest point

++ Recorded when plant gives new extension growth.

3. Inflorescence/Flower

Average of at least two 'on years' data. Recorded at bloom period.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flowering precocity (Year)*									
Date of first and last panicle initiation [YYYYMMDD]									
Date of opening of first and last male flower [YYYYMMDD]									
Date of opening of first and last pseudo-hermaphrodite flower (functional male) [YYYYMMDD]									
Date of opening of first and last non-functional pseudohermaphrodite flower (functional female) [YYYYMMDD]									
Flower composition in inflorescence**									
Flower disc/ inflorescence colour									

Duration of flowering [days]***									
Flower size									
Position of inflorescence									
Length of inflorescence**									
Width of inflorescence**									
Abundance of flowers									

*Specify number of years from budding/layering/grafting/seed sowing to first flower (i.e. 4 B/L/G/S indicates first flower produced 4 years after field establishment from the date of budding/layering/grafting/seed sowing, respectively)

** Average of ten inflorescences to be recorded

***Calculated from days to first flower opening to days to last flower opening.

4. Fruit

Recorded on well-developed 5 fruits per tree at harvest time, unless otherwise specified.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Number of years to first fruiting after sowing/planting [year]									
Date of initiation and end of fruit set [YYYYMMDD]									
Number of days from fruit set to fruit maturity [days]									
Start of fruit maturity [YYYYMMDD]									
End of fruit maturity [YYYYMMDD]									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Duration of fruit maturity [days]									
Fruit maturity group									
Fruit ripening									
Fruit bearing habit									
Fruit bearing intensity									
Fruit clustering habit									
Number of fruits per cluster/ inflorescence									
Fruit shape									
Fruit shoulders									
Fruit tip									
Fruit segments									
Fruit length [cm]*									
Fruit diameter [cm] *									
Fruit weight [g] *									
Cracking/ splitting of fruit skin									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruit skin thickness									
Mature fruit colour									
Distribution of colour on fruit surface									
Shape of tubercles/ protuberances									
Tubercle density									
Presence of suture									
Fruit attractiveness**									
Shelf life [days]*** (With colour retaining)									
Shelf life [days]*** (After peel browning)									
Weight of aril [g]*									
Aril thickness [mm]									
Aril texture (fully ripe fruits)									
Total sugars [%]									
Total soluble solids [°Brix]									
Vitamin C [mg/100 g pulp]									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Acidity [%]									
TSS/acidity ratio									
Aril quality [^]									
Aril flavor ^{^^}									
Aril juiciness									
Aril colour									
Productivity (Kg/tree)									
Fruit availability (days from first to last harvest)									
Fruit Bearing ^{^^^}									
Fruit quality at storage #									

*Average of ten fruits

**Combined assessment of shape, size and appearance, etc.

***Number of days fruit remains in good condition under storage at room temperature.

[^] Combined assessment of taste, flavour, juiciness and eye appeal.

^{^^} Assessed at the time of opening ripe fruit

^{^^^} 3-Poor, 5-Medium, 7-Heavy

Number of days of storage under ambient conditions

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

Photographs of fruit hanging on the tree (Please follow the instructions from the descriptor)

Sample 1 Photo	Sample 2 Photo
Sample 3 Photo	Sample 4 Photo

5. Seed

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Seed length [cm]*									
Seed width [cm]*									
100-Seed weight [gram]									
Seed shape									
Seed coat colour									

*Average of 20 seeds

6. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Sunburn susceptibility									
Mineral Toxicity**									
Soil salinity									
Constant winds									
Drought									
Water logging									

*These are coded in a susceptibility scale of 1-9 viz,:

0-Not susceptibility

3- Low

5-Medium

7-High

9- Very High

**1-Boron, 2-Zinc, 3-Chloride, 4-Copper, 5-Calcium, 6-Iron, 99-Other (specify in descriptor Notes)

7. Disease and pest susceptibility

S. N.	Disease and Pest	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
Example : Litchi rust		3	2	8	6	
1	Litchi rust					
2	Leaf/twig blight					
3	Flower blight					
4	Fruit rot					
5	Leaf and fruit spot					
6	Litchi fruit borer					
7	Litchi mites					
8	Bark eating caterpillar					
9	Leaf miner					

*Disease and pests should be scored in 1-9 scale where;

1-Very low or no visible sign of susceptibility

3- Low

5-Medium

7-High

9- Very High

Please refer the descriptor for more clarity on rating.

NOTES:

Please specify any additional information to be recorded regarding the accession which are not covered and stated as "Other" in above parameters.

Coffee (*Coffea Spp. And Psilanthus Spp.*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI. Descriptors for Coffee (*Coffea Spp. And Psilanthus Spp.*).
International Plant Genetic Resources Institute, Rome, Italy)



National Center for Fruit Development (NCFD)

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Email: ncfd.gov.np@gmail.com,

Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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

- (a) the *Système International d'Unités* (SI system) is used. The units to be applied are given in square brackets following the descriptor name;
- (b) 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 ungraded colour characters (the precise chart used should be specified in the section where it is used);
- (c) many quantitative characters which are continuously variable are recorded 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 | |

is the expression of a character. 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 9 (Biotic stress susceptibility), 1 = very low susceptibility and 9 = very high susceptibility;

- (d) when a descriptor is scored using a 1-9 scale, such as in (c), '0' would be scored when (i) the character is not expressed; (ii) when a descriptor is inapplicable. In the following example, '0' will be recorded if an accession does not have a central leaf lobe:

Shape of central leaf lobe

- 3 Toothed
- 5 Elliptic
- 7 Linear

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

Absence/presence of terminal leaflet

- 0 Absent
- 1 (or +) Present

- (f) blanks are used for information not yet available;

- (g) for accessions which 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 can be utilized, such as R.S. Rana et al. (1991), or van Hintum (1993), that clearly state a method for scoring heterogeneous accessions;

- (h) dates should be expressed numerically in the format DDMMYYYY, where

DD - 2 digits to represent the day

MM - 2 digits to represent the month

YYYY - 4 digits to represent the year

Information of Origin and Parentage (Collecting Descriptor)

1. Collector's Number:
(Passport data is prerequisite for this number-given by Gene-Bank)
2. Collecting Institute:
(Institute or person collecting/sponsoring the original sample)
3. Date of collection of original sample (Month/Year):
4. Country of collection or country where cultivar/variety bred:
5. Province/State from where sample is collected:
6. Location of collection site:
(Kilometers and direction from nearest town/village/landmark)
7. Latitude of collection site:
(Degrees and minutes followed by N (north) or S (south), e.g. 1030S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 7625W))
9. Altitude of collection site:
(Elevation above sea level in meters)
10. Collection source:
(1-Wild, 2-Farm land, 3-Farm store, 4-Backyard, 5-Village market, 6-Commercial market, 7-Institute, 8-Other, Specify in Notes)
11. Status of sample:
(1-Wild, 2-Weedy, 3- Primitive cultivar / landrace, 4- Breeder's line, 5-Advanced cultivar (bred), 6- Unknown 7-Other, specify in Notes)
12. Local Name:
(Name given by farmer to cultivar/landrace/weed)
13. Types of sample:
(1 Zygotic embryo, 2 Seed, 3 Vegetative, 4 Pollen, 5 Tissue culture (specify which part of the plant is used in descriptor notes))
14. Prevailing Stresses:
(Information on main associated biotic (pests and diseases) and abiotic (drought) stresses)
15. Genetic Erosion:
(Estimate the rate of genetic erosion of the species occurring in the region of collection; 3-Slow 5-Intermediate 7-Rapid)
16. Type of stem cuttings collected:
(1-Terminal shoots, 2- Lateral shoots, 3-Runners, 4-Hanging shoots)
17. End Use:
(1-Beverage, 2-Medicinal, 3-Other (specify in descriptor notes))

Environment and Site Information

(Characterization and evaluation site descriptors)

- Country of characterization and/or evaluation:
- Site (research institute/farm center/farm):
 - Name of farm or institute:
 - Latitude:
 - Longitude:
 - Elevation: (masl)
 - Slope: (degree)
 - Slope aspect: (ex-NE, SW, etc)
- Evaluator's name and address:
- Evaluation Year: (Starting date :MM/YYYY)
- Evaluation environment:
(Environment in which characterization/evaluation was carried out; 1-Field, 2-Screen house, 3- Glasshouse 4-Laboratory, 5-Other (specify in descriptor Notes))
- Planting or last stumping date [DDMMYYYY]:
- First harvest date [DDMMYYYY]:
- Last harvest date [DDMMYYYY]:
- Field Spacing: R-R , P-P
- Fertilizer:
(Specify types used, doses, frequency of each and method of application)
- Plant protection:
(Specify pesticides used, doses, frequency of each and method of application)
- Climate of the site:
 - Temperature (degree celcius):
Max Min Mean
(Seasonal maximum, minimum and mean temperature)
 - Rainfall (mm):
(Annual average, state number of recorded years)
 - Wind (Km s-1):
(Annual maximum wind velocity)
 - Frost:
Duration of temperature below freezing: days
Date of most recent frost: (DDMMYYYY)
 - Relative humidity:
Diurnal range: %
Seasonal range: %
 - Light: (Shady or Sunny)

Plant descriptors

During characterization and evaluation of the genetic resources, ten plants should be sampled per accession. Please refer the Coffee Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np. Please write down parameter's feature or value and code in each sample tree spaces in the table.

1. Tree

Parameters	No. of Sample Tree										Remarks
	1	2	3	4	5	6	7	8	9	10	
Plant habit											
Plant Height [cm]											
Trunk Diameter											
Overall appearance											
Vegetative development											
Branching habit											
Angle of insertion of primary branches											
Stipule shape											
Stipule arista length [mm]											

***Plant habit:** 1 Bush (<5 m ht - without distinct trunk), 2 Shrub or small tree (<5 m ht - 1 or more trunks, 3 Tree (> 5 m ht – single trunk)

***Plant Height (cm):** 1 Very Short, 3 Short, 7 Tall, 9 Very tall (Specify approx. tree age; Measured from ground level to top)

***Trunk Diameter:** Measured at 5 cm above ground level in seedling and cutting trees, or 10 cm above graft union in grafted tree. Specify approximate tree age

***Overall appearance:** 1 Elongated conical, 2 Pyramidal, 3 Bushy

***Vegetative development:** 1 Monopodial, 2 Sympodial

***Branching habit:** 1 Very few branches (primary)

2 Many branches (primary) with few secondary branches,

3 Many branches (primary) with many secondary branches,

4 Many branches (primary) with many secondary and tertiary branches

***Angle of insertion of primary branches (On the main):** 1 Drooping, 2 Horizontal or spreading, 3 Semi-erect

***Stipule shape:** 1 Round, 2 Ovate, 3 Triangular, 4 Deltate (equilaterally triangular), 5 Trapeziform, 6 Other (a stipule is a leaf-like structure present at the base of the leaf),

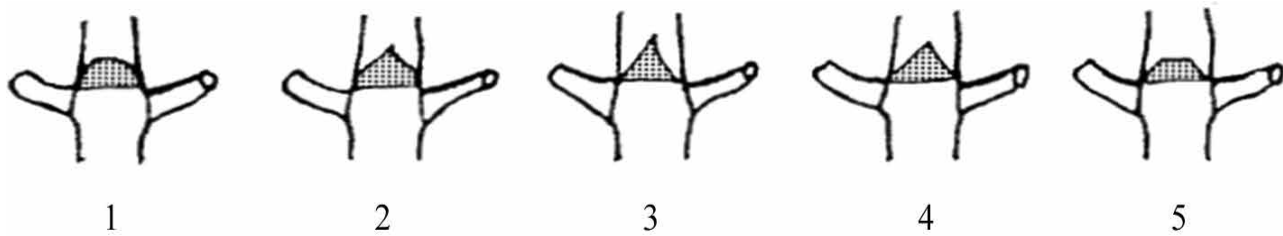


Figure 1 : Stipule shape

*Stipule arista length [mm]: Average of five well-developed stipule arista

2. Leaf

Parameters	No. of Sample Tree										Remarks
	1	2	3	4	5	6	7	8	9	10	
Young leaf color											
Leaf shape											
Leaf apex shape											
Leaf length (mm)											
Leaf width (mm)											
Leaf petiole length (mm)											
Leaf petiole color											
Young shoot color											
Mature leaf color											
Bud wax color											

Young leaf color: 1=Greenish, 2= Green, 3= Brownish, 4 = Reddish brown, 5= Bronze, 6 = Other

Leaf shape: 1 = Obovate, 2 Ovate, 3 Elliptic, 4 Lanceolate, 5 Other

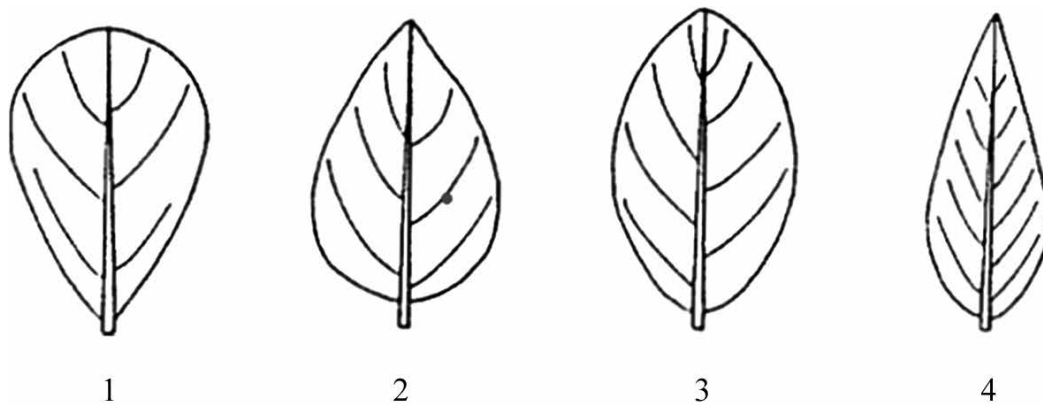


Figure 2 : Leaf shape

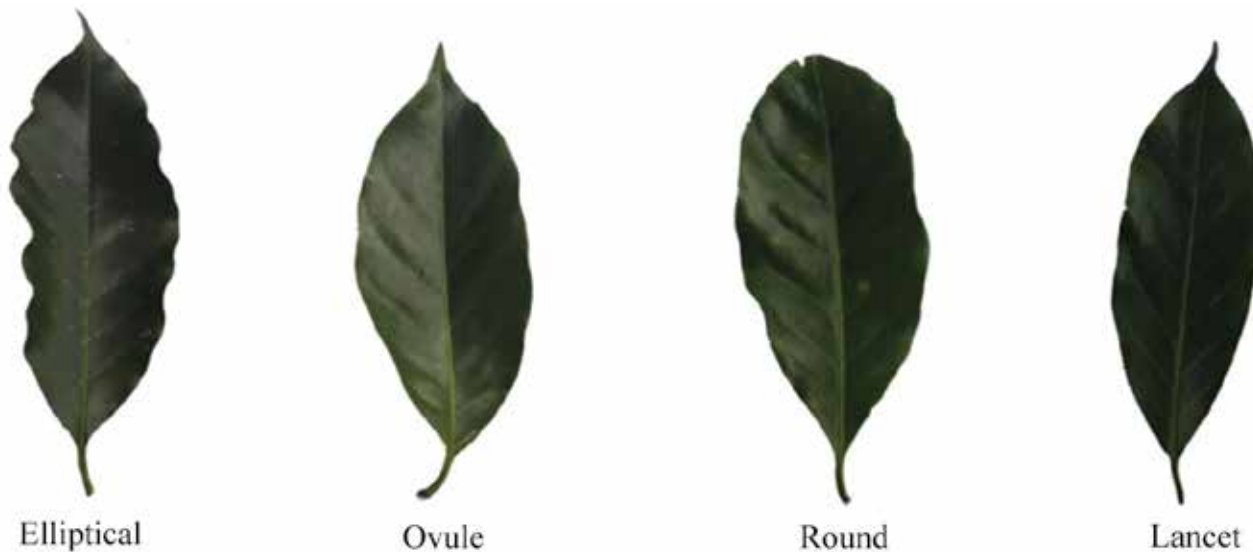


Figure 3 : Leaf shape

Leaf apex shape: 1 Round, 2 Obtuse, 3 Acute, 4 Acuminate, 5 Apiculate, 6 Spatulate, 7 Other (specify in descriptor 6.5 Notes)

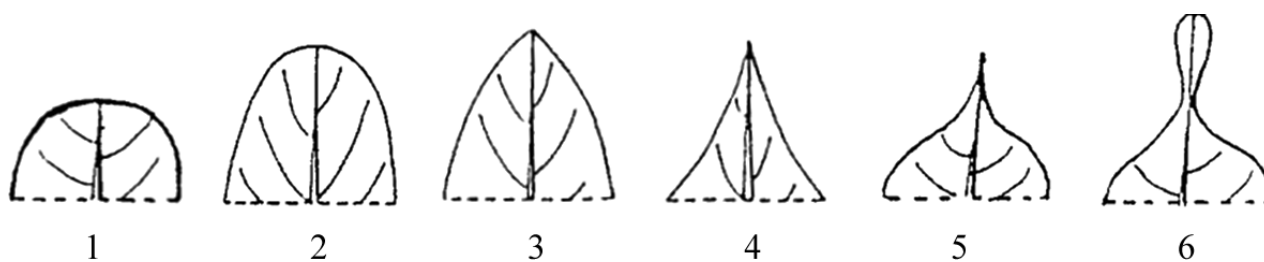


Figure 4 : Leaf apex shape

Leaf length (mm): Average of five mature (> node 3 from the terminal bud) leaves, measured from petiole end to apex

Leaf width (mm): Average of five mature (> node 3 from the terminal bud) leaves, measured at the widest part

Leaf petiole length (mm): Average of five one-year leaves, measured from the base to the insertion with the blade

Leaf petiole/young shoot/mature leaf color: 1 Green, 2 Dark brown, 3 Other

Bud wax color: 1 Yellowish, 2 Other

3. Inflorescence and flowering

Parameters	No. of Sample Tree										Remarks
	1	2	3	4	5	6	7	8	9	10	
Number of days from rainfall to flowering											
Inflorescence position											
Inflorescence on old wood											
Number of flowers per axil											
Number of flowers per fascicle											
Number of fascicles per node											
Inflorescence stalk length (mm)											
Corolla tube length (mm)											
Number of petals per flower											
Anther insertion											
Number of stamens per flower											

Inflorescence position: 1 Axillary, 2 Terminal

Inflorescence on old wood: 0 Absent, 1 Present

Number of flowers per axil: (Av. of 10 axils, randomly selected from different nodes)

Number of flowers per fascicle: (Average of 10 fascicles, randomly selected from different nodes)

Number of fascicles per node: (Average of 10 nodes, randomly selected from different branches)

Inflorescence stalk length (mm): (Average of five inflorescences, randomly selected from different nodes)

Corolla tube length (mm): (Average of five flowers, randomly selected from different nodes)

Number of petals/stamens per flower: Average of 10 flowers, randomly selected from different nodes

Anther insertion: 1 Excluded, 2 Included

4. Fruits

(For recording fruit descriptors, average of five observations should be made per sample tree)

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Fructification duration (d)					
Fruit color (Observed on mature fruits)					
Fruit shape					
Absence/presence of fruit ribs					
Fruit-disc shape					
Calyx limb persistence					
Fruit length (mm)					
Fruit width (mm)					
Fruit thickness(mm)					
Pulp thickness (In relation to berry/ bean)					
Harvest duration (d)					

Fructification duration (d): No. of days from bloom to first harvest, Record the bloom date because, in certain conditions, fructification duration depends on bloom period.

Fruit color (Observed on mature fruits): 1 Yellow, 2 Yellow-orange, 3 Orange, 4 Yellow-red, 5 Red, 6 Red purple, 7 Purple, 8 Purple-violet, 9 Violet 10 Black, 11 Other

Fruit shape (Average of five normal mature fruits): 1 Roundish, 2 Obovate, 3 Ovate, 4 Elliptic, 5 Oblong, 6 Other (Fig 5).

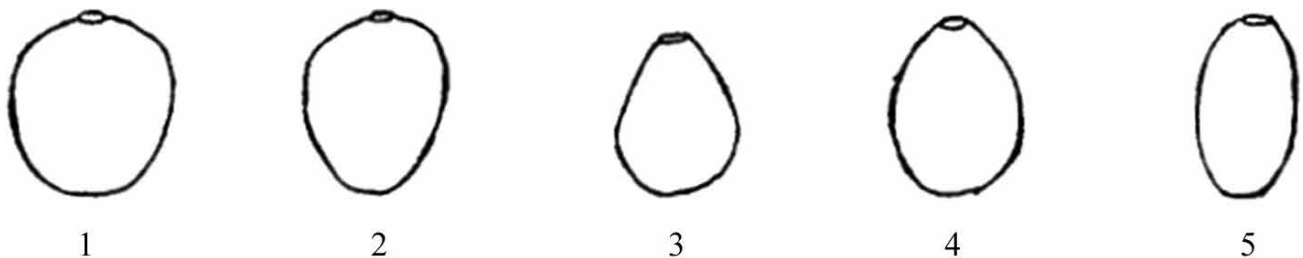


Figure 5 : Fruit shape

Fruit-disc shape: 1 Not marked, 2 Marked but not prominent, 3 Prominent (cylindrical), 4 Beaked (apex constricted into bottleneck shape)

Calyx limb persistence: 0 No, 1 Yes

Fruit length/width/thickness (mm): Average of five normal mature green fruits, measured at the largest part (length), widest part (width) and thickest part (thickness).

Pulp thickness (In relation to berry/ bean): 3 Thin, 5 Intermediate, 7 Thick

5. Yield characteristics (Specify the age of tree)

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Berry weight per tree (kg)					
Estimated yield (Rate in relation to age and volume of tree) canopy/area					
Empty-fruit rate (%)					
100-bean weight (g)					
Caracoli (Peaberry)-bean rate (%) Empty Locules (%) Fruit filling coefficient					

Berry weight per tree (kg): Record on harvested mature berries

Estimated yield (Rate in relation to age and volume of tree) canopy/area: 3 Very few fruits, 5 Few fruits on nearly all branches, 7 Many fruits on all branches

Empty-fruit rate (%): Scored by floating fruits (Record on at least 200 mature fruits)

100-bean weight (g): Calculated at 11% moisture content

Caracoli-bean rate (%): Percentage of caracoli (peaberry) beans (rounded beans form) in the Sample (Record on at least 200 mature fruits)

Fruit filling coefficient: Ratio of bean number over cherry number. As almost all cherries contain two locules, the fruit-filling coefficient varies between 0 (sterility) and 2 (complete fertility)

6. Seed

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Seed length (mm)					
Seed width (mm)					
Seed thickness (mm)					
Seed color (At 11% humidity)					
Seed shape					

Seed length/width/thickness (mm): Measured at maximum length, widest and thickest part respectively (average of five normal mature seeds)

Seed color (At 11% humidity): 1 Yellow, 2 Brown-purple

Seed shape: 1 Round, 2 Obovate, 3 Ovate, 4 Elliptic, 5 Oblong, 6 Other

7. Organoleptic Value

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
7.1 Acidity					
7.2 Bitterness					

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
7.3 Astringency					
7.4 Beverage-test value					

Acidity/ Bitterness/ Astringency: 3 Low, 5 Intermediate, 7 High

Beverage-test value: 3 Bad, 5 Intermediate, 7 Good

8. Abiotic stress susceptibility

Scored under artificial and/or natural conditions, which should be clearly specified. These are coded on a susceptibility scale from 1 to 9, viz.: 1-Very low or no visible sign of susceptibility, 3-Low, 5-Intermediate, 7-High, 9-Very high

Parameters	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Drought					
Mineral deficiencies					
Mineral toxicity					
Low temperature					
High temperature					
Water logging					
Lodging					

9. Disease and Pest susceptibility (Av. of five plants)

These are coded on a susceptibility scale from 1 to 9, viz.: 1-Very low or no visible sign of susceptibility, 3-Low, 5-Intermediate, 7-High, 9-Very high

S N	Diseases and pests	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	Anthraxnose					
2	Twig Dieback					
3	Stalk rot of berries and leaves					
4	Berry blotch					
5	Wilting					
6	Damping off					
7	Brown eye spot					
8	Pink disease					
9	Leaf spot					
10	Coffee Leaf rust					

S N	Diseases and pests	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
11	Brown blight of leaves					
12	White Stem Borer					
13	Red borer					
14	Green Scale					
15	Mealy bug					
16	Coffee berry borer					
17	Chaffer beetle					
18	Shot hole borer					
19	White grub					
20	Nematode					

NOTES:

Please specify any additional information to be recorded regarding the accession which are not covered and stated as “Other” in above parameters.