

TEMPERATE AND WARM TEMPERATE FRUIT CHARACTERIZATION AND EVALUATION DATA SHEET

(Apple, Walnut, Pecan, Almond, Pear, Persimmon, Kiwi)



National Center for Fruit Development (NCFD)

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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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Apple (*Malus Spp.*) Genetic Resources Characterization and Evaluation Datasheet

Adopted from:

Lateur M, Dapena E, Szalatnay D, Gantar M E, Guyader A, Hjalmarsson I, Höfer M, Ikase L, Kellerhals M, Lacis G, Militaru M, Miranda Jiménez C, Osterc G, Rondia A, Volens K, Zeljković M K, Ordidge M. 2022. ECPGR Characterization and Evaluation Descriptors for Apple Genetic Resources. European Cooperative Programme for Plant Genetic Resources, Rome, Italy.

Watkins R, Smith R.A. International Board for Plant Genetic Resources descriptor list for Apple (MALUS).



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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) measurements are made in metric units;
- b) many descriptors, which are continuously variable, are recorded on a 1-9 scale. 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 8 (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 = high to extremely high susceptibility;
- c) presence/absence characters are scored as + (present) and 0 (absent);
- d) for descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous;
- e) when the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower colour

1. White
 2. Yellow
 3. Red
 4. Purple
- f) blanks are used for information not yet available;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;
 - h) standard colour charts e.g. Royal Horticultural Society Colour Chart Methuen Handbook of Colour, Munsell Color Charts for Plant Tissues are strongly recommended for all ungraded colour characters. The precise chart used should be specified in the NOTES descriptor.

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.

General notes on methodology for characterization

- Data should be recorded on representative trees and ideally, data should be recorded in representative years.
- Extreme climatic conditions such as high spring temperature, severe spring frost or hail are known to affect floral phenology and fruit set/quality.
- Ideally, data from several representative years should be recorded before accessions can be fully classified.
- All recorded dates should be transformed into number of days from the first of January. Phenological classifications can then be expressed as '+' or '-' (X) day differences from the reference cultivars classified in the medium period.
- It is important to organize training for technicians and field workers who will perform the evaluation. It is recommended to check the reproducibility of data (between data collected on the same object by different observers) and the repeatability (between observations made by the same observer at different times).

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. 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))
16. 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)
- Rootstock:
(Name of the rootstock on which the accession is grafted (if any))
- Condition of the tree:
(Choose the one condition that best fits the accession: 1-Dead, 2-Dying, 3-Old, declining, 4-Mature, diseased, 5-Mature, non-vigorous, 6-Mature, vigorous, 7-Non-bearing, 8-Healthy - cropping poorly, 9- Healthy - cropping well.)
- 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, four plants should be sampled per accession. Please refer the Apple 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	
Architecture									
Fruit Bearing habit									
Tree vigour									
Scion-rootstock compatibility									
Suckering tendency (rootstock)									
Dwarfing**									

* Natural habit of an untrained, non-juvenile tree

** Direct growth controlling effect of the rootstock or interstock on the cultivar

Tree Photographs:

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
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2. Growing stage

S.N.	Growth stages	Observed date Sample 1	Observed date Sample 2	Observed date Sample 3	Observed date Sample 4
1	Dormant				
2	Silver Tip				
3	Green Tip				
4	Half Inch Green				
5	Tight Cluster				
6	Pink bud				
7	1 st Flower Open				
8	Full Bloom (90% flower open)				
9	Petal fall				
10	Fruit Set				
11	Fruit Maturity				
12	1 st Leaf Fall				
13	Complete Leaf Fall				

स्याउको वृद्धिका अवस्थाहरु

स्याउको बयस्क बोटको बार्षिक वृद्धि विकासका चक्रका अवस्थाहरु (स्याउ बिरुवामा कोपिला अवस्था देखि फल टिप्ने सम्मका अवस्थाहरु) निम्न बमोजिम हुन्छन् :

१		सुषुप्त अवस्था (Dormant Stage): स्याउको बोटका पातहरु सबै भरेका हुन्छन् ।
२		सिल्भर टिप अवस्था (Silver Tip Stage): कोपिला बढ्नु थाल्दछ, कोपिलाका पत्रहरु फक्रिन शुरु हुन्छ, कोपिला हेर्दा चाँदीको जस्तो सेतो देखिन्छ ।
३		ग्रीन टिप अवस्था (Green Tip Stage): कोपिला बढ्नु थाल्दछ, कोपिलाको बढ्ने क्रम जारी रहन्छ र कोपिलाको साइज पहिलेको भन्दा ठूलो हुन्छ ।
४.		आधा ईंच ग्रीन अवस्था (Half Inch Green Stage): कोपिला बढ्दै जाँदा स्याउको पातको निश्चित आकार देखिन थाल्दछ ।
५		टाइट क्लस्टर अवस्था (Tight Cluster Stage): <ul style="list-style-type: none"> ■ केही दिनको वृद्धि विकासपछि बीच भागमा कस्सिएर रहेका, अलि भुस भएको फूल लाने कोपिलाहरु देखिन थाल्दछन् । ■ फूलका कोपिलाहरुको बढ्ने क्रम जारी रहन्छ । ■ फूलका कोपिलाहरुको वृद्धि विकास हुँदै जाँदा फूलका भागहरु (Petals) र ५ वटा अलि भुस भएका सेपलहरु (Sepals) देखिन थाल्दछन् । ■ फूलको डाँठ लामो हुँदै जान्छ र साइज पनि बढ्दै जान्छ ।
६		गुलाबी अवस्था (Pink Bud Stage): फूलका कोपिलाहरु मध्येबाट बीचको फूल फक्रिने र फूलको भित्र भागहरु देखिन थाल्दछ । पेटलको रंग भित्रपट्टी सेतो र बाहिरतिर गुलाबी धब्बाहरु देखिन्छ ।
७		पूर्ण फूलेको अवस्था (Full Bloom Stage): केन्द्रतिरबाट स्टामेनहरु बाहिरतिर Flare out, सेतो फिलामेन्टको टुप्पामा पहेंलो एन्थर रहेको हुन्छ । स्त्रीकेशर फूलको बीचमा रहेको हुन्छ जसमा टुप्पामा स्टीगमा, बीच भाग स्टाइल र तल ओभरी रहेको हुन्छ जुन पेटलहरु निस्कने स्थानको नजिकमा रहेको हुन्छ ।

८		<p>फूलको पंख झरेको अवस्था (Petal Fall Stage):</p> <p>फूलका स्त्रीकेशर र पूँकेशर परिपक्व भएपछि सेचनक्रिया हुन्छ । सेचन क्रियापछि एन्थर खैरो कालो हुँदै चाउरिन्छ र पेटलहरू ओझलिएर झर्न थाल्दछ तर साना हरिया सेपलहरू भने रहेकै हुन्छन् ।</p>
९		<p>फल लाग्ने अवस्था (Fruit Setting Stage):</p> <p>ओभरी बढ्न थाल्दछ । ओभरी बढ्दै जाँदा पहिले बाहिरतिर फक्रिएका सेपलहरू तन्किएर सिधा हुन थाल्दछन् । यसै क्रममा स्तामेन चाउरिन गइ सुक्न थाल्दछ । सेपललाई माथि पाउँदै फलको साइज बढ्दै जान्छ । सेपलको साइज सधैँ एउटै हुन्छ तर हेर्दै जाँदा तुलनात्मक रूपमा सानो भइरहेको भान हुन्छ ।</p>
१०		<p>फल बढ्ने अवस्था (Fruit Development Stage):</p> <p>यस अवस्थामा स्याउ स-साना भुसले ढाकिएको Fuzzy देखिन्छ । स्तामेनहरू निरन्तर सुक्दै जान्छन् र दब्यैगएका सेपलहरू भित्र ती स्तामेनहरू हराउँदै गएको देखिन्छ । केही हप्ताको वृद्धि पछि फलले स्याउको आकार लिन्छ र स-साना भुसहरू पनि बिलाउँदै जान्छन् ।</p>
११		<p>फल परिपक्व हुने अवस्था (Fruit Ripening Stage):</p> <p>स्याउको बोटमा प्रकाश संश्लेषण हुँदै जाँदा प्रशस्त स्टार्च तयार हुँदै फलमा समेत भण्डारण हुँदै जान्छ र फलको तौल पनि बढ्दछ फलस्वरूप पहिले सिधाभई बढीरहेको स्याउको फल अब तलतिर झुण्डिन्छ । घाम तथा चिसो तापक्रम पाउँदा स्याउमा जात अनुसारको रातो, हल्का पहेँलो रंग चढ्न थाल्दछ । स्याउको सतहमा रहेका स-साना थोप्लाहरूबाट पनि स्याउले अक्सिजन लिने गर्दछ । सतहमा मैनाको एक पातलो भिल्ली पनि रहेको हुन्छ जसले फलबाट निस्कने पानीलाई केही हदसम्म रोक्नमा मद्दत पुऱ्याउँदछ ।</p>
१२		<p>फल टिप्ने अवस्था (Harvesting Stage):</p> <p>स्याउ टिप्ने अवस्थामा स्याउ फललाई लामो गरेर काटेर हेर्दा बीचको भाग (Core) जहाँ बीउ रहेको हुन्छ त्यहाँ पहिलेको फूलको डाँठ अहिले फलको डाँठ बनेको हुन्छ । स्याउको डाँठ तिरको भागको बिपरिततिरको टुप्पामा बिचार पुऱ्याएर हेरियो भने फूलको अवस्थामा देखिएको ५ वटा सेपलहरू तारा आकारमा साँगुरिएका हुन्छन् । यदि यो भागलाई चलाउने हो भने सुकेर चाउरिएका स्तामेनहरू देख्न सकिन्छ ।</p>

चित्र नं. १: स्याउको बोटको वार्षिक वृद्धि विकासका अवस्थाहरू (१ देखि १२ सम्म)

3. Flower

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flowering Intensity									
Flowering period (season)									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flower colour									
Regularity of flowering									

4. Fruit

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Relative harvest maturity									
Tendency to drop fruit at harvest time									
Relative Precocity of fruit bearing									
Productivity (Kg/tree)									
Relative productivity									
Fruit height-width mean ratio (Shape)									
Regularity of shape									
Presence of ribs in top view									
Avg fruit diameter (mm)									
Avg Fruit weight (gm)									
Fruit Size*									
Fruit crowning at apex									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Colour of fruit skin									
Amount of over colour									
Over colour									
Overall russet coverage									
Tendency for greasiness during storage									
Aperture of eye									
Length of stalk									
Flesh color at eating maturity									
Average number of seeds (10 fruits)									

*Overall assessment of fruit diameter and weight.

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

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
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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. Fruit quality

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruit firmness									
Skin thickness									
Flesh sweetness									
Flesh acidity									
Ratio between acidity and sweetness									
Flesh Juciness									
Flesh crunchiness									
Intensity of fruit aroma									
Overall fruit quality									
Fruit storage life									

6. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Low temperature (late autumn/ early winter)									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Low temperature (mid winter)									
Low temperature (spring)									
High temperature									
Drought									
High soil moisture									
Chlorosis									

*Based on the 1-9 scale, where 1-Extremely low susceptibility 3-Low susceptibility 5-Medium susceptibility 7-High susceptibility 9-Extremely high susceptibility

7. Disease and pest susceptibility

S. N.	Disease and Pest	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Example : Woolly aphid	3	2	8	6	
1	Woolly aphid					
2	San jose scale					
3	Foot rot					
4	Root rot					
5	Pink disease					
6	Papery bark					
7	Sooty blotch					
8	Scab					
9	Powdery Mildew					
10	Canker					
11	Fire blight					
12	Blossom wilt					
13	Fruit brown rot					

S. N.	Disease and Pest	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
14	Anthracnose of leaves and fruits					
15	Rosy aphid					

*Disease and pests should be scored in 1-9 scale where; 1 refers to no visible symptoms to 9 as maximum infection with more than 50% incidence and more than 75% severity. 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.

Walnut (*Juglans Spp.*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from IPGRI. 1994. Descriptors for Walnut (*Juglans 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 internationally accepted standards for the scoring or coding of descriptor states should be followed as indicated below:

a) measurements are made in metric units;

b) many descriptors, which are continuously variable, are recorded on a 1-9 scale. 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 8 (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 = high to extremely high susceptibility;

c) presence/absence characters are scored as + (present) and 0 (absent);

d) for descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous;

e) when the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower colour

1. White
2. Yellow
3. Red
4. Purple

f) blanks are used for information not yet available;

g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;

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. All observations on the fruits should be made on fruits ripened on the tree.

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. Collecting Site Population Structure:
(1-No. of trees sampled, 2-Frequency of accession at collecting site 3-Associated flora)
15. 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))
16. Collecting source environment:
(slope, altitude, soil)
17. Cultural Methods:
(1-cropping system, 2-propagation method, 3-irrigation)
18. Plant Population Density:
(low, intermediate, high)
19. Prevailing Stresses:
(Biotic and Abiotic stresses)

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 (°):
 - Slope aspect:
- Evaluator's name and address:
- Sowing or Grafting Date (in the format of DDMMYY)
- Evaluation Year: (Starting date DD/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 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)
- Collecting and/or characterization /Evaluation site environment:
 - Overall vegetation surrounding at collection site:
 (Grassland, woodland, forest, shrubland)
 - Soil drainage:
 - Soil moisture:
 - Soil pH:
 - Soil organic matter content:
 - Water availability:
 (rainfed, irrigated, flooded, riverbanks)
- Evaluation Environment:
 (Environment in which evaluation/characterization was carried out; Field, Screenhouse, Glasshouse, Laboratory, Other)
- Condition of tree:
 (Dying, Old, Mature, Young, Healthy)
- Number of Days to 50% field emergence:
- Sowing Site in Field:
- Tree spacing:
 (PP distance and RR distance in m)
- Fertilizer:
 (specify names, doses, Frequency of each and method of application)
- Plant Protection:
 (specify pesticide names, doses, Frequency of each and method of application)

Plant Descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Please refer the Walnut (*Juglans Spp.*) Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np. Average of at least 2 years data required for characterization of *Juglans* Species.

1. Phenology

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Date of bud break [YYYYMMDD]									
First male bloom date									
Male peak bloom date									
Last male bloom date									
First female bloom date									
Female peak bloom date									
Last female bloom date									
Harvest date									
Defoliation date									

***Date of vegetative bud break** - When over 50% of terminal buds have enlarged and the bud scales have split exposing the green of the leaves inside.

***First male bloom date** – When first pollen shedding occurs (in format of DDMMYY).

***Peak male bloom date**– When maximum pollen shedding occurs (in format of DDMMYY).

* **Last bloom date** - When last pollen shedding occurs (in format of DDMMYY)

* **First female bloom date**- Date of initial pistillate flower receptivity

* **Female peak bloom date**- Date of maximum pistillate flower receptivity (in format of DDMMYY)

* **Last female bloom date**- Date of last pistillate flower receptivity (in format of DDMMYY)

***Harvest date**- when nuts are harvestable, take a random sample which is representative of entire tree (in format of DDMMYY)

***Defoliation date** (in format of DDMMYY)

2. Growth

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree Vigor									
Tree growth habit									
Branching									

***Tree Vigor:** (3- Low, 5- Intermediate, 7-High)

* **Tree Growth Habit:** (1- erect, 2-Semi-Erect, 3-Spreading)

* **Branching Density:** (3-Sparse, 5-Intermediate, 7-Dense)

Tree Photographs:

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

3. Leaf descriptors

Record average of 10 fully expanded representative leaves, collected from different trees when shoots are lignified. Do not select leaves that are out of the ordinary due to pruning and excessive vigour.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf Color									
Leaf length (cm)									
Leaf width (cm)									
Number of leaflets									
Leaflet length									
Leaflet width									
Leaflet shape									

***Leaf length (cm)** - Measured from the base of petiole to the tip of terminal leaflet)

***Leaf width-** Measured at the widest part

***Leaf Color** - (3-Yellow, 5-Green, 7-Dark green)

***Leaflet length (cm)-** (measured from the point of attachment to the tip)

***Leaflet width-** Measured at the widest part

***Leaflet shape** - (1- Narrow, 2-Elliptic, 3- Broad elliptic)

4. Inflorescence

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Dichogamy									
First Catkin bearing year									

Alternate Bearing									
Catkin (male flower) abundance									
Flowering precocity									
Lateral bud flowering									
Female flower abundance									
Flower per inflorescence									
Fruit set									
Hull splitting index									
Hull persistence after nut fall									
Hull dehiscence									

***Dichogamy** (1-Protandrous, 2-Protogynous, 3- Unknown)

***First catkin bearing year** (no. of years from seed or graft to first catkin bearing year)

***Alternate bearing** (3-Slight, 5-Moderate, 7- Significant)

***Catkin abundance** (3-light, 5 intermediates, 7 heavy)

***Flowering precocity** - Specify number of years from graft or seed to first flower (i.e. 4G indicates first flower produced 4 years after graft establishment).

***Lateral bud flowering** (% current season lateral shoots with female flowering in young trees)

* **Female flower abundance** (3-Light, 5- Intermediate, 7-Heavy)

***Flower per inflorescence** (Most frequent no. of flowers recorded in 10m terminal inflorescence)

***Fruit set-** When fruit set occurs (in the format of DDMMYYYY)

***Hull splitting index** (3-slight, 5-moderate, 7-significant)

***Hull persistence after nut fall** (3- slight, 5-Moderate, 7-significant)

***Hull dehiscence:** 1- non dehiscent, 2-slightly dehiscent, 3- Dehiscent)

5. Nut and Kernel

Average of 20 sound nuts except for kernel color and shriveling parameter.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Nut length [mm]									
Nut diameter [mm]									
Nut shape									
Nut shell texture									
Nut shell color									
Nut shell seal									
Shell strength									
Shell integrity									
Shell thickness									
Packing tissue brown date									
Packing tissue thickness									
Inshell nut weight									
Kernel weight									
Kernel percentage									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Kernel flavor									
Kernel fill									
Kernel plumpness									
Ease of removal of kernel halves									
Kernel shrivel									
Kernel color									
Blank nut									
Yield (Kg/ha)									

***Nut and Kernel length** - Average of at least 25 nuts, measured from the most distant points along main seed axis.

* Nut diameter-face to face(mm).

***Nut shape**- (Longitudinal to perpendicular to suture) (1-round, 2 triangular, 3-broad ovate, 4-ovate, 5-short trapezoid, 6-Long trapezoid, 7- Broad elliptic, 8-Elliptic, 9-Cordate)

***Nut shell texture** (1-very smooth, 3 smooth, 5 medium, 7 rough, 9 very tough)

* **Nutshell color** (1 very light, 3 light, 5 medium, 7 dark, 9 very dark).

***Nutshell seal** (1 open 2 very weak, 3 weak, 5 intermediate, 7 strong, 9 very strong)

***Shell strength** (1 paper, 3 weak, 5 intermediate, 7 strong)

***Shell integrity** (1 incomplete shell, 2 intermediate, 3 complete shell no holes)

***Shell thickness in mm** (near center or half shell)

***Packing tissue brown date** (when packing tissue in 80% of nuts have completed browning in format of DDMMYY)

***Packing tissue thickness** (1 very thin, 3 thin, 5 medium, 7 thick, 9 very thick)

***Inshell nut weight(g)**

***Kernel weight(g)** avg of 20 sound kernels

***Kernel percentage** (Kernel weight/nut weight *100)

***Kernel flavor** (1 satisfactory, 2 unsatisfactory)

***Kernel fill** (3 poor, 5 moderate ,7 well)

***Kernel plumpness** (3 thin, 5 moderates, 7 plump)

***Ease of removal of kernel halves** (1 very easy, 3 easy, 5 moderate, 7 difficult, 9 very difficult)

***Kernel shrivels (%)** based on 20 randomly selected nuts

***Kernel color in %** (based on 20 randomly selected nuts, use walnut color chart, 1 extra light, 2 light, 3 light amber, 4 amber, 5 yellow)

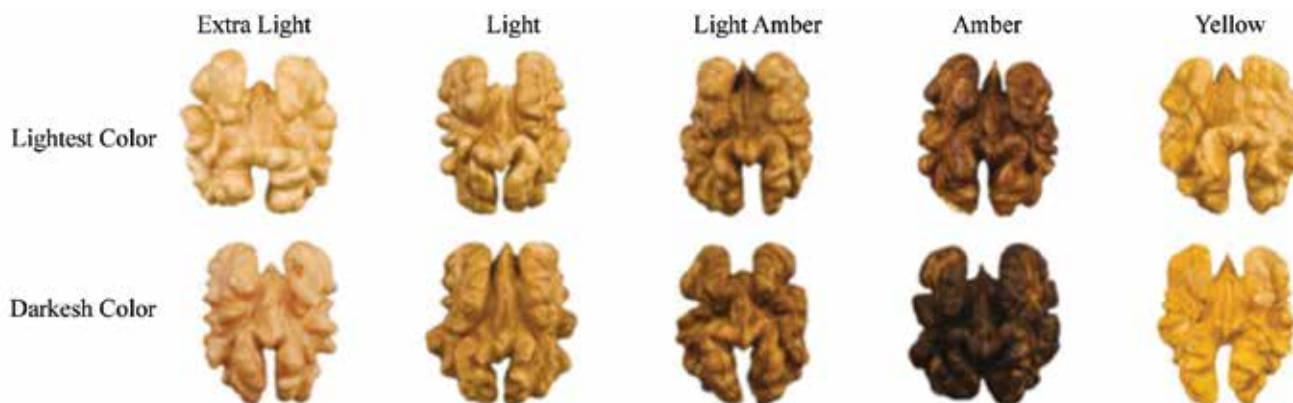


Figure 1: Walnut color chart, United States Department of Agriculture

***Blank nut (%)** based on 20 randomly selected nuts

6. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Mineral Deficiency									
Mineral Toxicity									
Salinity									
Low temperature (Spring)									
High temperature									
Drought									
Water logging									

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

1-Very low or no visible sign of susceptibility

3- Low

5-Intermediate

7-High

7. Disease and pest susceptibility

S. N.	Disease and Pest	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Example : Canker	3	2	8	6	
1	Anthracnose					
2	Walnut Blight					
3	Phytophthora root and crown rot					
4	Fire blight					
5	Crown gall					
6	Canker					
7	Codling moth					
8	Walnut weevil					
9	Shoot borer					
10	Leaf eating caterpillar					

*Disease and pests should be scored in 1-9 scale where; 0- No sign of susceptibility, 1-Very low or almost 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.

Pecans (*Carya illinoensis*) Genetic Resources Characterization and Evaluation Datasheet



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

- a) measurements are made in metric units;
- b) many descriptors, which are continuously variable, are recorded on a 1-9 scale. 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 8 (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 = high to extremely high susceptibility;
- c) presence/absence characters are scored as + (present) and 0 (absent);
- d) for descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous;
- e) when the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower colour

1. White
 2. Yellow
 3. Red
 4. Purple
- f) blanks are used for information not yet available;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;

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- introduced, 7-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. 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))
16. 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 evaluation/characterization was carried out; Field, Screenhouse, Glasshouse, Laboratory, Other)
- Condition of tree:
(Dying, Old, Mature, Young, Healthy)
- 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)
- Number of Days to 50% field emergence:
- Tree spacing:
(PP distance and RR distance in m)
- Fertilizer:
(specify names, doses,Frequency of each and method of application)
- Plant Protection:
(specify pesticide names, doses, Frequency of each and method of application)

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Observe the same individual plant and plant parts each time you visit your site. For that, you should mark the plant and the branches of that plant from where you record data. Please refer the Pecans descriptor for pictures and clarification of parameters as well as method to measure & record it @www.ncfd.gov.np.

1. Principal Growth stages

The principal growth stages of pecans are divided into vegetative and reproductive phenology.

S. N.	Growth stages	Observed date Sample 1	Observed date Sample 2	Observed date Sample 3	Observed date Sample 4
1	Swollen bud visible				
2	Bud Burst : Bud scale splits				
3	Catkins development begins : Inflorescence primordium becomes visible				
4	Beginning of male flowering : 10% of the flowers open				
5	Beginning of female flowering : 10% of the flowers open				
6	Full Bloom (more than 50% flower open)				
7	Fruit set visible				
8	Water Stage: Nut interior fills with water				
9	Gel stage: Immature kernel fills with gel like substance				
10	Dough stage: Kernel gel begins to solidify				
11	Splitting of Husk : Shell exposed				
12	Starting of nut fall				
13	Completion of Harvesting				
14	Beginning of Leaf Fall				
15	Complete Leaf Fall: Beginning of dormancy				

2. Tree

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree growth habit									
Tree vigor									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Density of branches									
Fruit bearing habit									
Collar girth									
Root System									

- Tree growth habit - Upright (1), Semi -upright (2), Spreading(3)



1. Upright



2. Semi-upright



3. Spreading

Figure 1 : Tree growth habit

***Fruit Bearing habit** - Spur(1), Old branches (2), One year old shoot (3)

***Tree vigor** - Weak (1), Medium (2), Strong (3), The vigor of the plant should be considered as the overall abundance of vegetative growth.

***Density of branches:** The density of branches of the plant should be considered as the overall abundance of branches during the dormant period.

* **Collar girth-** It is measured at 4.5 feet (1.4 m) above ground level.

* **Root system-** Fibrous (1), Tap (2)

Tree Photographs:

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

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

3. Leaf

Observations should be made on fully developed leaves (10 per tree) on the middle section of a one year old shoot at the end of leaflet expansion. Do not select leaves that are out of the ordinary due to pruning and excessive vigour.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Terminal leaflet ratio length/width									
Lateral leaflet: asymmetry at base									
Length of Terminal leaflet Petiole									
Presence of Petiole in Lateral leaflet									
Leaf shape									
Time of leaf bud burst (date)									
Time of leaf fall (date)									

***Presence of petiole in lateral leaflet** - absent(0),present(1)

***Leaf shape** - narrow elliptic(1), elliptic(2), broad leaf(3)

***Time of leaf bud burst** : The time of leaf burst is when 75% of the buds are open.

***Time of leaf fall**: The time of leaf fall is when 75% of the leaves have fallen.

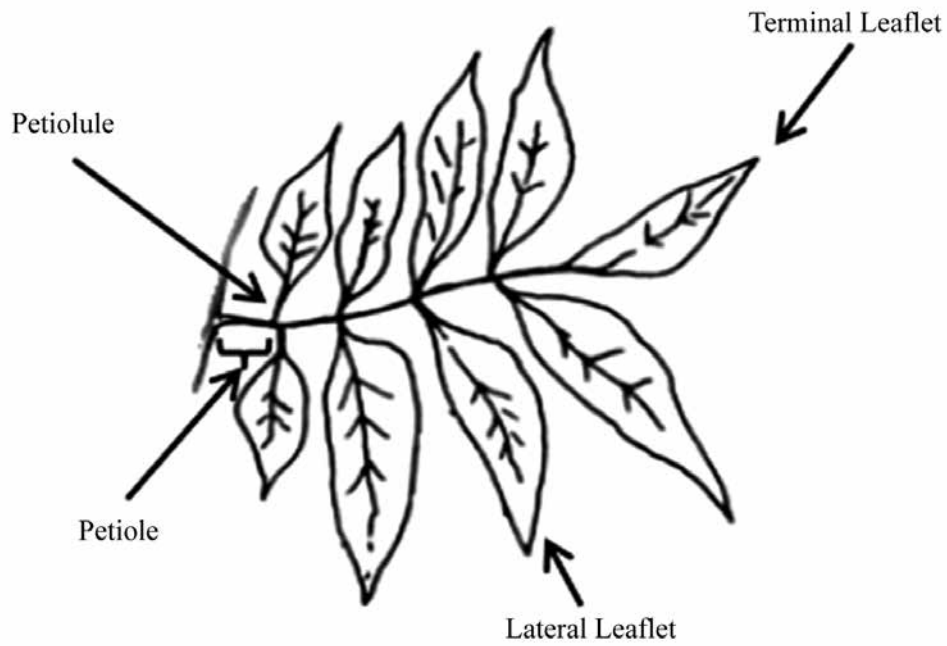


Figure 2: Overall Leaf

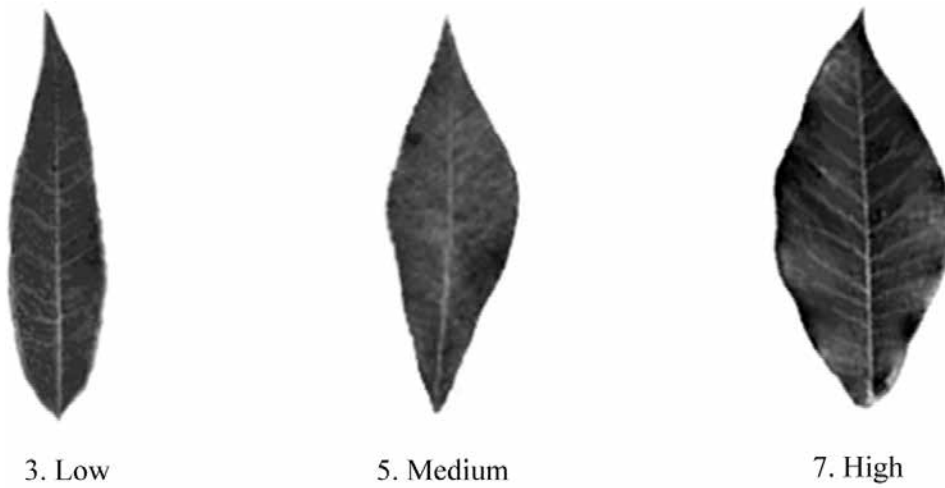


Figure 3: Terminal leaflet ratio

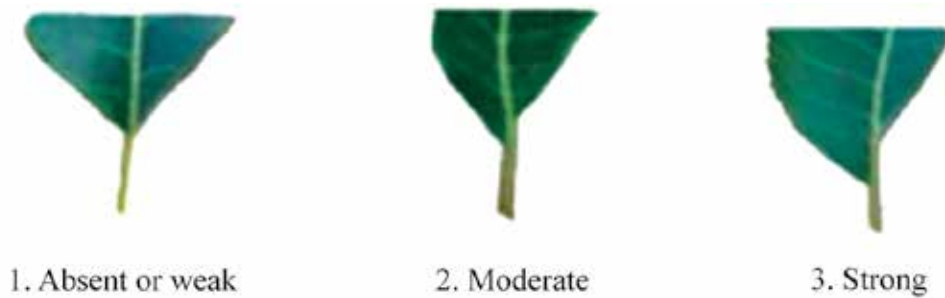


Figure 4: Lateral leaflet asymmetry at base

4. Flower

Observations should be made at full receptivity of stigma when stigma is turgid and sticky. Observations should be made on the terminal section of a one-year-old shoot.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Bud burst									
Catkin length									
Number of flowers									
Flowering Intensity									
Flower color									
Regularity of flowering									
Stigma splitting									

***Bud burst**- Protandrous(1), Protogynous (2)

***Flowering Intensity** - Sparse(1), Medium(2), Dense(3)

***Flower color** - Green(1), Creamy(2)

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

***Stigma splitting** - Absent or Weak(1), Moderate(2), Strong(3)

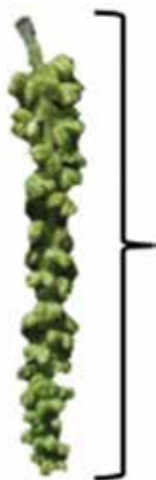


Figure: Catkin Length



1. Absent or weak



2. Moderate



3. Strong

Figure 5: Stigma Splitting

Flower Photographs

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

5. Fruits (Nut)

Observations should be made on fully developed nuts from the terminal section of a one-year-old shoot at husk opening stage. For the observations on the fruit, 10 typical fruits should be selected out of each trees.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Precocity of fruit bearing									
Prominence of ribs in Husk									
Nut length (mm)									
Nut width (mm) in lateral view									
Nut width (mm) in lateral view facing the suture									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Nut shape in lateral view									
Nut Shape of apex in lateral view									
Length of tip in nut (mm)									
Nut ground color									
Nut: Area covered by spots									
Thickness of nut shell (mm)									
Persistence of husk after nut fall									
Productivity (Kg/tree)									
Regularity of fruiting									
Av. Nut weight (in gm)									
Time of husk opening (date)									

- *Precocity of fruit bearing - early(1), medium(2), late(3)
- *Prominence of ribs in Husk - weak(1), medium(2), long, (To be observed before husk opening)
- *Nut shape in lateral view - ovate(1), circular (2), elliptic(3), oblong(4), obovate(5)
- *Nut ground color - grey brown(1), light brown(2), dark brown(3), The color is observed on the surface of the nut, disregarding the spots.
- *Nut: Area covered by spots - small (1), medium(2), large(3)
- *Persistence of husk after nut fall - not persistent(1), partially persistent(2), fully persistent(3), The persistence of the husk is its retention on the shoot after the fall of the nuts. The observation is made during late winter.
- *Regularity of fruiting – regular(1), biennial(2), irregular(3)
- * Time of husk opening- The time of husk opening is when 75% of the husks are split.

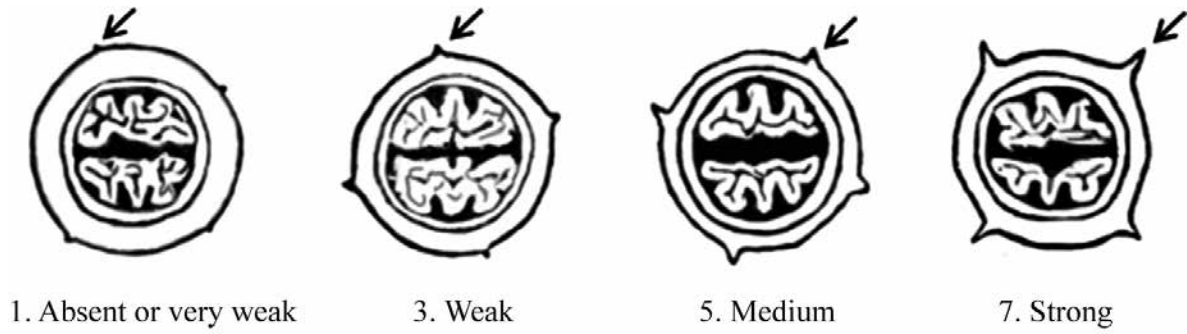
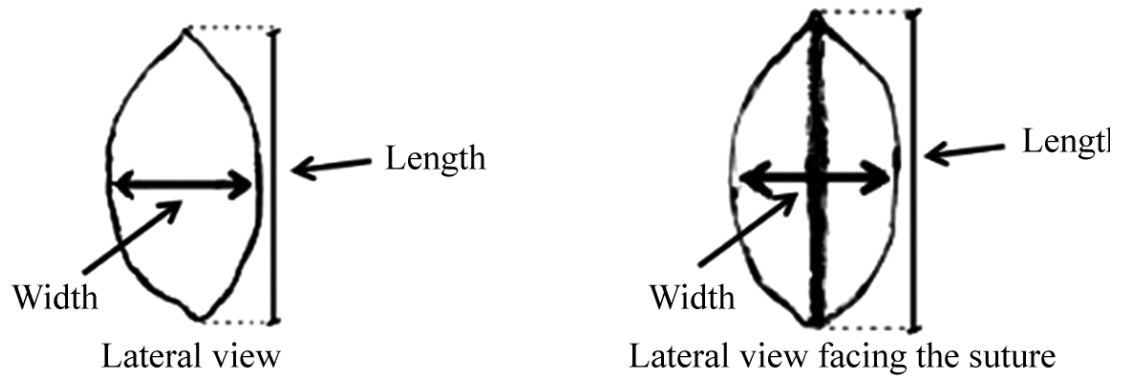


Figure 6: Prominence of ribs in husk

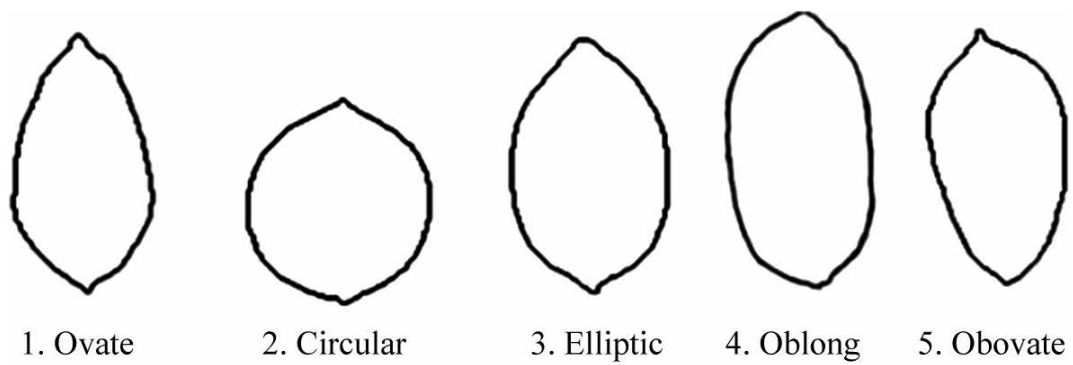


Figure 7: Nut shape in lateral view

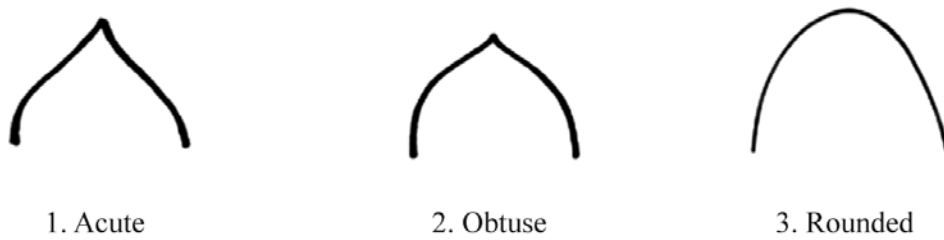


Figure: Nut Shape of apex in lateral view (excluding tip)



Figure 8: Length of tip in nut

Sample fruit photographs

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

Photographs of fruit hanging on the tree

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

6. Fruit quality (Kernel)

Average of 20 sound nuts from each trees should be observed.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Kernel fill									
Kernel size in relation to nut size									
Kernel weight (gm)									
Shell strength									
Oil content									

*Kernel fill – poor(1), moderate(2), well(3)

*Kernel weight- The weight of the kernel should be assessed as the average weight of 10 kernels when ready for consumption.

*Shell strength - papery(1), weak(2), intermediate(3), strong(4)

*Oil content - high(1), medium(2), low(3)

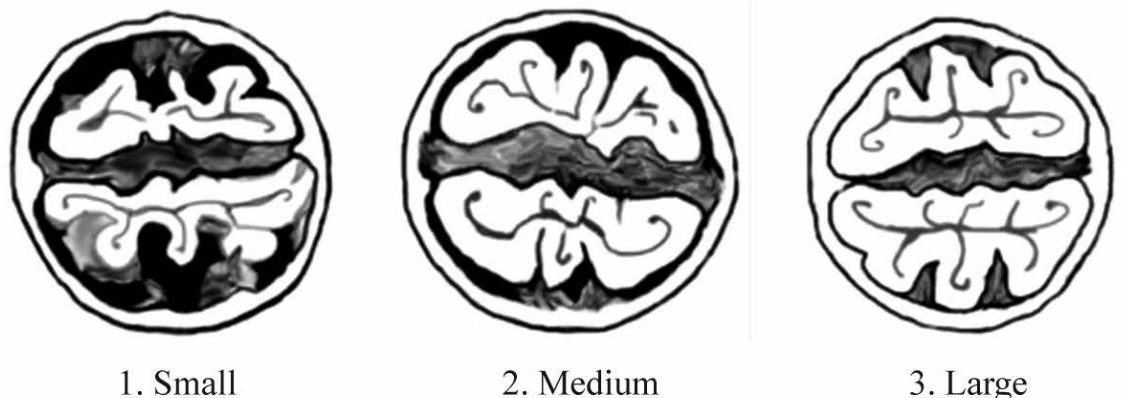


Figure 9: Kernel size in relation to nut size

7. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Mineral Deficiency									
Mineral Toxicity									
Salinity									
Low temperature (Spring)									
High temperature									
Drought									
Water logging									

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

1-Very low or no visible sign of susceptibility

3- Low

5-Intermediate

7-High

9- Very High

8. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
	Example : Blight	2	5	7	4	
1	Pecan scab					
2	Anthracnose					
3	Blight					
4	Pecan nut casebearer					
5	Aphid					
6	Pecan weevil					

*Disease and pests should be scored in 1-9 scale where; 0- No sign of susceptibility, 1-Very low or almost 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.

References:

Han, M., Peng, F., & Marshall, P. (2018). Pecan phenology in southeastern China. *Annals of Applied Biology*, 172(2), 160-169.

UPOV, (2015). Guidelines for the conduct of tests for distinctness, Uniformity and Stability of Pecan nut (*Carya illinoensis*). <https://www.upov.int/edocs/tgdocs/en/tg308.pdf>.

Zhang, R., Peng, F., Liang, Y., Hao, M., & Li, Y. (2015). Flowering and pollination characteristics of Chinese-grown pecan (*Carya illinoensis*). *Acta horticulturae*, 1070(1070), 43-51.

Almond (*Prunus amygdalus*) Genetic Resources Characterization and Evaluation Datasheet

(Parameters adopted from: R Gulcan 1985 the International Board for Plant Genetic Resources descriptor list for almond (*Prunus amygdalus*) (Revised).)



National Center for Fruit Development (NCFD)

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Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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

- a) measurements are made in metric units;
- b) many descriptors, which are continuously variable, are recorded on a 1-9 scale. 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 8 (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 = high to extremely high susceptibility;
- c) presence/absence characters are scored as + (present) and 0 (absent);
- d) for descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous;
- e) when the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower colour

1. White
 2. Yellow
 3. Red
 4. Purple
- f) blanks are used for information not yet available;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;

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. All observations on the fruits should be made on fruits ripened on the tree.

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. 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))
16. 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)
- 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)
- Rootstock:
Name of rootstock on which accession is grafted (if any)
- Condition of 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
- Cropping efficiency: (..... kg/tree)

3-Cropping poorly, 5-Intermediate, 7-Cropping well

(The yield per unit area of land relative to other cultivars on the same rootstock, under the same management system at the same site)

- Propagation method:
- Suitable method(s) employed for multiplication (0 = No, 1 =Yes)
- Inflorescence and flowering:

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Season of flowering (Date of full flower)									
Harvest maturity									

- **Kernel:**

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Kernel Size									
Kernel Shape									

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Please refer the Almond 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		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree habits									
Tree vigour									
Ramification									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Coloration of shoot tip (1 year old shoots)									
Foliage density									
Scion-rootstock compatibility									
Tree chilling requirement									
Heat requirement for flower bud brusting									

Tree Photographs:

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

2. Inflorescence and Fruit

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Location of flower buds									
Duration of flowering (Days)									
Tendency to binneal bearing									
Self-compatibility of flowers									
Precocity of bearing									
Color of petals									
Double flower in buds									
Number of pistils									
Ease of harvesting									
Ease of hulling									
Nut size									
Nut shape									
Shell color intensity									
Marking of outer shell									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Suture opening of the shell									
Shell retention									
Softness of shell									

Sample Fruit photographs

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

3. Kernel

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Kernel color intensity									
Shriveling of kernel									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Kernel pubescence									
Kernel taste									
Percentage of sound kernels (Out of 100 sample kernels)									
Percentage of double kernel (Out of 100 sample kernels)									
Percentage of twin kernels									

Sample kernel photographs

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

4. Stress Susceptibility

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
General field susceptibility									
Low temperature (Spring)									
High temperature									
Drought									
High soil moisture									
Chlorosis									

Please see the scale in the descriptor for rating each stress parameter. (1-9 scale is used) where, 3 low, 5- Medium, 7 High.

5. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
Example	Scale	3	2	8	6	
1	Fungal Gummosis					
2	Bacterial Gummosis					
3	Scale					
4	Aphid					
5	Other (Specify)					

*Disease and pests should be scored in 1-9 scale where; 1-3 refers to low susceptibility. 4-6 refers to intermediate and 7-9 as high susceptibility. Please refer the descriptor for more clarity on rating.

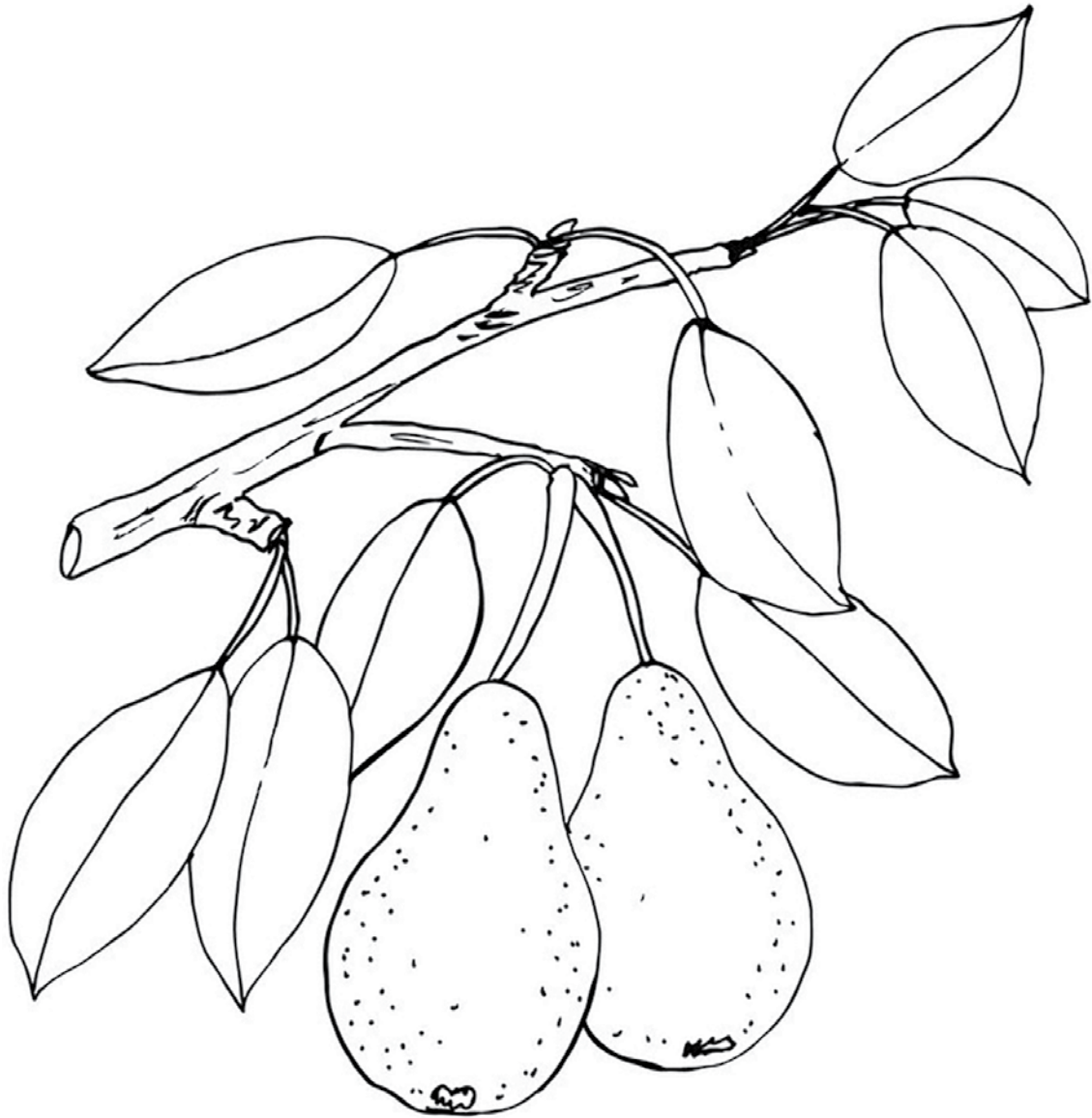
NOTES:

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

Pear (*Pyrus communis*) Genetic Resources Characterization and Evaluation Datasheet

Adopted from:

Lateur M, Szalatnay D, Höfer M, Bergamaschi M, Guyader A, Hjalmarsson I, Militaru M, Miranda Jiménez C, Osterc G, Rondia A, Sotiropoulos T, Zeljković M K, Ordidge M. 2022. ECPGR Characterization and Evaluation Descriptors for Pear Genetic Resources. European Cooperative Programme for Plant Genetic Resources, Rome, Italy.



National Center for Fruit Development (NCFD)

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Web: www.ncfd.gov.np

Scoring and Coding the Parameters

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- b) Many descriptors, which are continuously variable, are recorded on a 1-9 scale. 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 8 (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 = high to extremely high susceptibility;
- c) presence/absence characters are scored as + (present) and 0 (absent);
- d) For descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous;
- e) When the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower color

1. White
 2. Yellow
 3. Red
 4. Purple
- f) Blanks are used for information not yet available;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources.

General notes on methodology for characterization

- Data should be recorded on representative trees.
- Ideally, data should be recorded in representative years.
- Extreme climatic conditions such as high spring temperature, severe spring frost or hail are known to affect floral phenology and fruit set/quality. Ideally, data from several representative years should be recorded before accessions can be fully classified.
- All recorded dates should be transformed into number of days from the first of January.
- Phenological classifications can then be expressed as '+' or '-' (X) day differences from the reference cultivars classified in the medium period.

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. Collecting site population structure:
(No.of trees sampled, 2- Frequency of accession at collecting site, 3- Associated flora)
15. 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)
16. Cultural Methods:
(1-..... Cropping system, 2-Propagation method, 3-irrigation)
17. Plant propagation Density :
(Low, Intermediate, High)
18. Prevailing Stresses:
(Biotic and Abiotic stresses)
19. Virus disease status (Including Pollinizer)
(1-Virus disease free**, 2-Virus disease tested (infected)**, 3-Not tested **
Record results of virus tests in the NOTES (positive or negative))
20. 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 (°):
 - Slope aspect :
- Evaluator's name and address:
- Sowing or Grafting Date: (in the format of DD/MM/YYYY)
- Rootstock: (Name of rootstock in which accession is grafted.)
- Evaluation Year: (Starting date : DD/MM/YYYY)
- 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: (DD/MM/YYYY)
 - Relative humidity:
 - Diurnal range: %
 - Seasonal range: %
 - Light: (Shady or Sunny)
 - Soil moisture :
 - Soil organic matter content :
 - Water availability :
(Rainfed, Irrigated, Flooded, Riverbanks)
- Evaluation Environment :
(Environment in which evaluation/characterization was carried out; Field, Screenhouse, Glasshouse, Laboratory, others)
- Condition of the tree:
(1-Dead, 2-Dying, 3-Old declining, 4-Mature diseased, 5-Mature non vigorous, 6-Mature vigorous, 7- Young not yet bearing, 8- Others)
- Number of days to 50% field emergence :
- Tree spacing:
(PP distance and RR distance in meter)

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Observe the same individual plant and plant parts each time you visit your site. For that, you should mark the plant and the branches of that plant from where you record data. Please refer the Pear Descriptor for pictures and clarification of parameters as well as methods to measure and record it @ www.ncfd.gov.np.

1. Principal growth stages

S.N.	Growth stages	Observed Date				
		Sample 1	Sample 2	Sample 3	Sample 4	Remarks
1	Dormant					
2	Swollen bud					
3	Bud Burst					
4	Green Cluster					
5	White Bud					
6	Bloom <ul style="list-style-type: none"> • Beginning of Flowering • Full Bloom 					
7	Petal fall					
8	Fruit Set					
9	Fruit Maturity					
10	Senescence <ul style="list-style-type: none"> a) Beginning of leaf fall b) Complete leaf fall 					

***Dormant:** Fruit bud relatively inactive. This is the overwintering stage.

* **Swollen bud:** Fruit bud swollen, scales separated to expose the areas of lighter colored tissues.

* **Bud Burst:** Fruit buds broken at tips showing tips of blossom ends.

***Green cluster:** Blossom buds green, mostly separated in the cluster, stem lengthened.

***White bud:** Blossom buds white, separated in the cluster, stem lengthened.

***Bloom:** Blossom buds open.

a) **Beginning of Flowering:** 10% of flower buds are open.

b) **Full bloom:** more than 50% of flower buds are open.

***Petal fall:** After about 75% of petals have fallen.

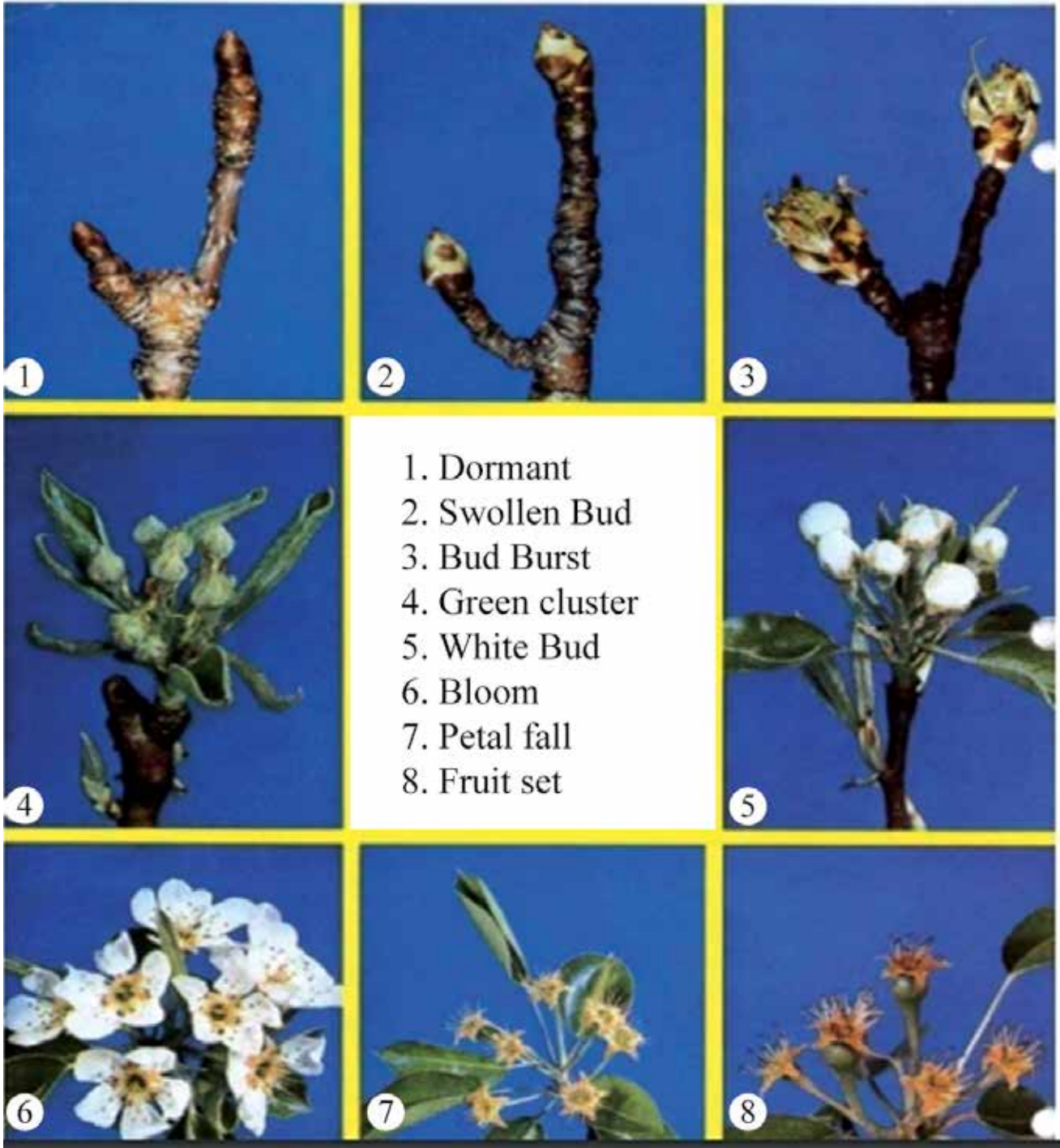
***Fruit set:** A stage ranging from 4 to 10 days after bloom when the blossoms that have or have not set fruits, initially, is clearly evident.

***Fruit maturity:** When the fruits are ready to harvest for their commercial use.

***Senescence:**

a) **Beginning of Leaf fall:** 10% of leaves fall down.

b) **Complete leaf fall:** 90% of leaves fall down.



(Chapman, P.J. and Catlin, A. Gertrude, 1978)

Figure 1: Growth stages of pear

2. Trees

Tree characteristics should be recorded from untrained and fully matured tree. Unless otherwise stated all observations on the tree and on the one year old shoot should be made during winter on trees that have fruited at least once.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Growth habit									
Fruit Bearing habit									
Tree vigour									
Canopy diameter (m)									
Collar girth (cm)									

***Growth habit** :- Fastigate (1), Upright (2), Semi- upright (3), Spreading (4), Drooping (5), Weeping (6). (Observe in 10 year old tree)

***Fruit Bearing habit**: - Spur (1), Old branches (2), One year old shoot (3), Others (4- Please specify)

***Tree vigor**:- Weak (3), Medium (5), Strong (7)

***Canopy diameter**:- Measured by covering the canopy area of tree.

Tree Photographs

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

3. Leaves

Unless otherwise stated all observations on the leaf should be made in summer in fully developed leaves from the middle third of a well-developed current season shoot.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Details	Code	Details	Code	Details	Code	Details	
Length of leaf blade (cm)									
Width of leaf blade (cm)									
Length/Width Ratio of leaf blade									
Petiole length (cm/mm)									
Incisions of margin (Upper half)									
Shape of leaf blade									

***Length of leaf blade:** - Length of leaf excluding the petiole length.

* **Width of leaf blade:** - Measured at the maximum width of leaf.

***Petiole length:-** Leaf length excluding the length of leaf blade.

***Incisions of margin (Upper half) :-** Absent (1), Crenate (2), Bluntly serrate (3), Sharply serrate (4)

***Shape of leaf blade :-** Elliptic(1), Ovate (2), Obovate (3)

4. Flower

Unless otherwise stated all observations on the flower should be made on fully developed flowers at the beginning of anther dehiscence. Before categorizing the accession, some parameters such as regularity of flowering, frequency of off season flowering, intensity of offseason flowering the plants should be observed for four to six representative years.

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flowering Intensity									
Flower color									
Regularity of flowering									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Intensity of offseason flowering									
Frequency of offseason flowering									
Inflorescence type									
No. of flowers in an inflorescence									
Length of sepal (mm)									
Length of petal (mm)									
Flower diameter (mm)									
Position of Stigma in relation to stamens									

***Flowering intensity:-** No flower (1) - Absence of any flower, Extremely Low, (2) - Flower clusters represent up to 5% of all buds, Low, (3) - Flower clusters represent approx 10% of all buds, Low to Medium, (4) – X, Medium, (5) - Flower clusters represents approx 30% of all bud, Medium to high, (6) – X, High, (7) – Flower clusters represents approx 50% of all bud, High to extremely high, (8)- X, Extremely high, (9) –Over 90% of all buds are floral. Where; X : Intermediate rating

***Flower color :-** White (1), Others (2- Specify)

***Regularity of flowering :-** Very often irregular/ Biennial(1), Intermediate behavior (2), Very often regular(3)

***Intensity of offseason flowering:-** Low (1)- Absence of any offseason flowering, Medium, (2)- Flower cluster represents up to 5% of all buds, High, (3)- Flower cluster represents more than 5 % of all buds

***Frequency of offseason flowering:-** Rare (1), Intermediate (2), Frequent (3)

***Inflorescence type:** - Cymose (1), Racemose (2)

***Length of sepal, Length of petal , Flower diameter :-** measured at fully opened flower.

***Position of Stigma in relation to stamens:-** Below (1), Same level (2), Above (3)

Flower photographs

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

5. Fruits

Unless otherwise stated sample of 6-12 representative fruits should be evaluated and all observations should be made at the time of maturity for consumption. Same protocol should be used for all the accessions and the terminal fruit should be avoided.

Parameters	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Precocity of fruit bearing									
Profile of bottom of fruit									
Relative position of maximum diameter									
Length of fruit									

Parameters	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Maximum diameter of fruit									
Ratio of length and maximum diameter of fruit									
Fruit symmetry in longitudinal section									
Fruit shape in cross section									
Fruit shape									
Regularity of shape									
Length of fruit stalk									
Depth of Fruit stalk cavity									
Color of fruit skin at maturity									
Color of over mature fruit skin									
Abundance of white speckles/ Lenticels on Fruit skin									
Number of seeds									
Shape of seeds									

Parameters	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tendency to drop fruit at Maturity/harvest time									
Average Fruit weight (gm/fruit)									
Productivity (kg/tree)									

***Precocity of fruit bearing:-** Extremely low (1), Low (2), Intermediate (3), High (4), Extremely high (5)

***Profile of bottom of fruit:-** Concave (1), Straight (2), Convex (3)

***Relative position of Maximum diameter:-** Toward the middle (1), Toward the eye (2)

***Length of fruit (cm):-** Measured at the maximum length.

* **Maximum diameter of fruit (cm):-** Measured at the position of maximum diameter.

***Fruit symmetry in longitudinal section:-** Symmetric (1), Slightly asymmetric (2), Strongly asymmetric (3)

***Fruit shape in cross section:-** Circular (1), Ovate (2) , Irregular (3)

* **Fruit shape:-** Circular (1), Ovate (2) , Obovate (3), Oblong (4) Acute (5), Irregular (6)

***Regularity of shape:-** Regular shape (1), Slightly variable shape (2), Highly variable shape (3)

***Length of fruit stalk:-** Very short: <15 mm (1), Short : 15-24 mm(2), Medium: 25-34 mm (3), Long : 35-44 mm (4), Very long : > 45 mm (5)

***Depth of Fruit stalk cavity:-** Stalk in continuity with the fruit flesh (1), Absent (2), Very shallow (3), Shallow (4), Medium (5), Deep (7),Very deep (9)

***Color of fruit skin at maturity:-**Yellow (1), Whitish yellow (2), Green yellow (3), Whitish Green (4), Green (5), Yellow-Orange (6)

(If the color doesn't match with the given options please mention the color according to field observations)

***Color of over mature fruit skin:-** Absent (0), Orange (1), Pink /red(2), Red (3), Dark red (4), Purple (5), Brownish red (6)

(Mention the color according to field observations)

***Abundance of white speckles on Fruit skin:** - Absent (1), few (2), many (3)

***Number of seeds:-** Absent(1), 1-3 (2), 4-5 (3), 6-10 (4), 11-15 (5) >15 (6)

(An average of fully formed seeds from approximately 12–20 fruits should be calculated.)

***Shape of seeds:-** Round (1), Ovate (2), Elliptic (3), Narrow elliptic

***Tendency to drop fruit at Maturity/harvest time:-** No drop observed (0), Very low drop : 1- 10% (2),Low drop : 11-25 % (3), Low to medium : X (4), Medium : \pm 50% (5), Medium to high : X (6), High : \pm 75%, High to very high : X, Very high : >75%

* **Average Fruit weight (gm/fruit) :** Extremely small (1), Very small (2), Small (3), Small to medium (4), Medium (5), Medium to large (6), Large (7), Very large (8), Extremely large (9)

(At least 12 fruits should be evaluated over the period of 4-6 representative years)

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

6. Fruit quality

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruit Firmness									
Skin thickness									
Flesh sweetness									
Flesh Crunchiness									
Flesh acidity									
Ratio between acidity and sweetness									
Flesh juiciness									
Intensity of fruit aroma									
Presence of grit cells in flesh									
Fruit flesh texture									
Fruit storage - life									
Intensity of water soaked lesion on flesh during storage									
Overall fruit quality									

***Fruit firmness:** - Soft (3), Medium (5), Firm (7)

***Skin thickness:** - Very thin (2), Thin (3), Medium (5), Thick (7), Very Thick (8)

***Flesh sweetness:-** Extremely low (1), Very low (2), Low (3), Intermediate (5), High (7), Very high (8), Extremely High

***Flesh acidity :-** Extremely low (1), Very low (2), Low (3), Intermediate (5), High (7), Very high (8), Extremely High (9)

***Ratio between acidity and sweetness :-** Extremely more acid than sweet (1), Much more acid than sweet (2), More acid than sweet (3), Good balance acid/sugar (5), More sweet than acid (7), Much more sweet than acid (8), Extremely more sweet than acid (9).

***Flesh Juiciness :-** Extremely low (1), Very low (2), Low (3), Intermediate (5), High (7), Very high (8), Extremely High (9)

***Intensity of fruit aroma :-** Extremely low (1), Very low (2), Low (3), Medium (5), High (7), Very high (8), Extremely High (9)

***Fruit flesh texture: -** Extremely fine (1), Very fine (2), Fine (3), Intermediate (5), Coarse (7), Very coarse (8), Extremely coarse (9)

***Presence of grit cells in the flesh :-** Extremely low (1), Very low (2), Low (3), Medium (5), High (7), Very high (8), Extremely High (9)

***Fruit storage life :-** Short (3), Intermediate (5), Long (7), Specify the storage conditions in remarks.

***Intensity of watersoaked lesion on flesh during storage :-** Absent (0), low (3), Medium (5), High (7)

***Overall fruit quality:-** Extremely poor (1), Very poor (2), Poor (3), Poor to good (4), Good (5), Good to very good (6), Very good (7), Extremely good (9)

7. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
Example : Root rot		3	2	8	6	
1	Papery bark					
2	Root rot					
3	Leaf spot					
4	Mealy bug					
5	Fruit fly					
6	Thrips					
7	Stem borer					
8	White grub					

*Disease and pests should be scored in 1-9 scale where; 1 refers to no visible symptoms to 9 as maximum infection with more than 50% incidence and more than 75% severity. Please refer the descriptor for more clarity on rating.

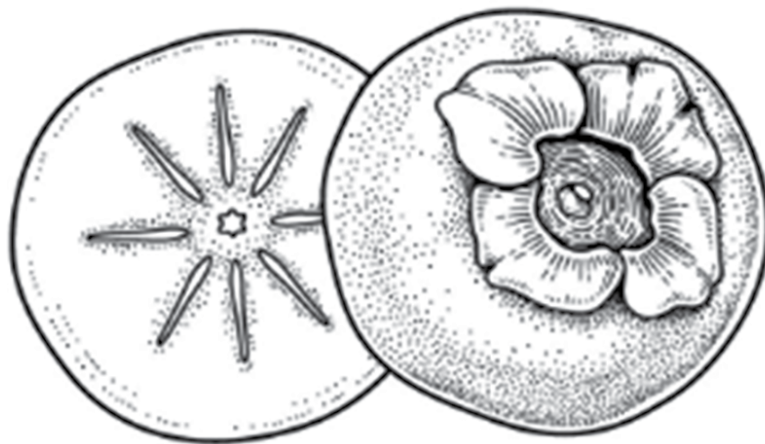
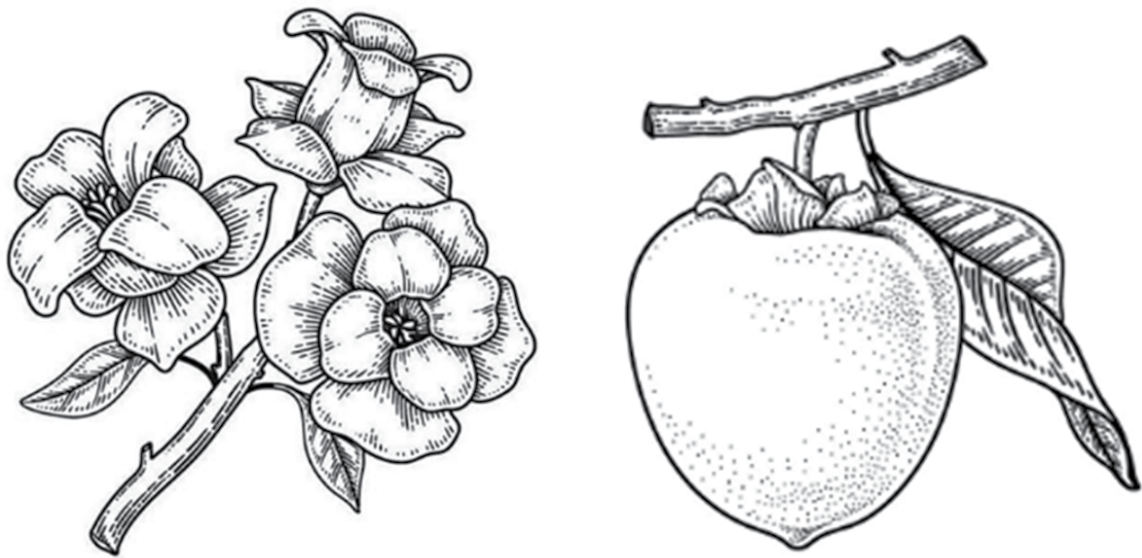
Notes :

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

References :

1. Chapman, P. & Catlin, G. (1976). Growth stages in fruit trees from dormant to fruit set.
2. https://www.ecpgr.org/fileadmin/biodiversity/publications/pdfs/ECPGR_Pyrus_descriptors_Final_27-06-22.pdf
3. <https://www.upov.int/edocs/tgdocs/en/tg015.pdf>.
4. Lateur M, Szalatnay D, Höfer M, Bergamaschi M, Guyader A, Hjalmarsson I, Militaru M, Miranda Jiménez C, Osterc G, Rondia A, Sotiropoulos T, Zeljković M K, Ordidge M. 2022. ECPGR Characterization and Evaluation Descriptors for Pear Genetic Resources. European Cooperative Programme for Plant Genetic Resources, Rome, Italy.

Persimmon (*Diospyros Spp.*) Genetic Resources Characterization and Evaluation Datasheet



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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) measurements are made in metric units;
- b) many descriptors, which are continuously variable, are recorded on a 1-9 scale. 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 8 (Pest and disease susceptibility) 1 = extremely low susceptibility and 8 = high to extremely high susceptibility;
- c) presence/absence characters are scored as + (present) and 0 (absent);
- d) for descriptors which are not generally uniform throughout the accession (e.g. mixed collection, genetic segregation) mean and standard deviation could be reported where the descriptor is continuous or mean and 'x' where the descriptor is discontinuous;
- e) when the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower colour

- 1. White
 - 2. Yellow
 - 3. Red
 - 4. Purple
- f) blanks are used for information not yet available;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;

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- introduced 7- 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. Rootstock used in studied sample:
15. 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))
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)
- 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)
- Evaluation Environment :
(Environment in which evaluation/characterization was carried out; Field, Screenhouse, Glasshouse, Laboratory, others)
- Condition of the tree:
(1-Dead, 2-Dying, 3-Old declining, 4-Mature diseased, 5-Mature non vigorous, 6-Mature vigorous, 7- Young not yet bearing, 8- Others)
- Number of days to 50% field emergence :
- Tree spacing:
(PP distance and RR distance in meter)

Plant descriptors

During characterization and evaluation of the genetic resources, four plants should be sampled per accession. Observe the same individual plant and plant parts each time you visit your site. For that, you should mark the plant and the branches of that plant from where you record data.

1. Principal Growth stages:

The principal growth stages of persimmon are divided into vegetative and reproductive phenology.

S. N.	B BCH Code	Principal Growth stages	Observed date Sample 1	Observed date Sample 2	Observed date Sample 3	Observed date Sample 4
A		Vegetative Phenology	mm/dd	mm/dd	mm/dd	mm/dd
1	0	Sprouting/ Bud development Stage				
	00	Dormancy: Bud closed and covered by brown scales.				
	01	Beginning of bud swelling: Bud begin to elongate.				
	03	End of leaf bud swelling: Brown scales slightly separated.				
	07	Beginning of bud burst: First green leaf tips just visible.				
	09	Green leaf tips visible: Green leaf tip around 5 mm above bud scales.				
2	1	Leaf development Stage				
	10	Mouse ear stage : Green leaf tips 10 mm above the bud scales				
	11	First leaf unfolded (other still unfolding)				
	15	More leafs unfolded, not yet at full size				
	19	First leaf fully expanded				
3	3	Shoot development stage				
	31	Beginning of shoot growth : axes of developing shoot visible				
	33	Shoot about 30% of final length				
	35	Shoot development continues				
4	9	Senescence and beginning of dormancy				
	95	50% of leaves discolored/start to show orange color				
	97	All leaves fallen				
B		Reproductive Phenology				

S. N.	BBCH Code	Principal Growth stages	Observed date Sample 1	Observed date Sample 2	Observed date Sample 3	Observed date Sample 4
1	5	Inflorescence emergence stage				
	51	Inflorescence buds swelling : bud scales elongated, with light colored patches				
	53	Bud burst: green leafy sepals visible				
	55	Flower buds visible (still closed)				
	57	White bud stage : flower petal just visible				
	59	Most flower bud with clearly observed petals (but un-open)				
2	6	Flowering stage				
	60	First flower open				
	62	About 20% of flower open				
	64	About 40% of flower open				
	65	About 50% of flower open				
	67	Flowers fading : majority of petals fallen				
	69	End of flowering: all petals fallen				
3	7	Fruit development stage				
	71	Fruit size up to 10 mm : fruit fall after flowering				
	72	Fruit size up to 20 mm				
	74	Fruit diameter up to 40 mm				
	75	Fruit about half of final size				
	77	Fruit about 70 % of final size				
	79	Fruit about 90 % of final size				
4	8	Fruit maturity stage				
	81	Beginning of ripening: first appearance of cultivar specific color				
	85	Advance ripening: increase in intensity of cultivar-specific color				
	87	Fruit ripe for picking				
	89	Fruit ripe for consumption: fruit have typical taste and firmness				

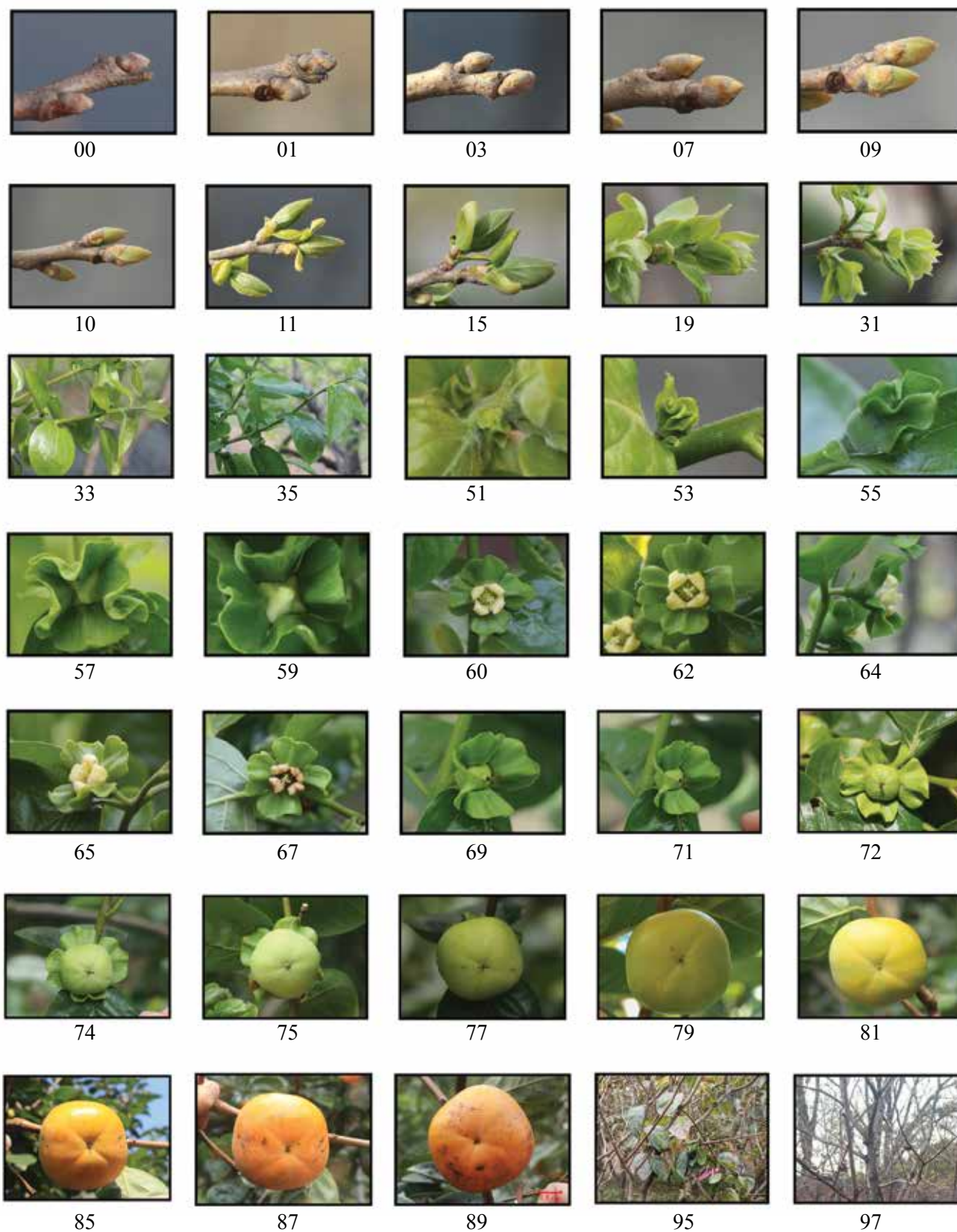


Figure 1 : Growth stages for persimmon according to the BBCH scale.

2. Trees:

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Tree habit									
Fruit Bearing habit									
Tree vigor									
Collar girth									

***Tree habit** - Upright (1), Semi upright (2), Spreading (3), Drooping (4)

***Fruit bearing habit**- Spur (1), Old branches (2), One year old shoot (3)

***Tree vigor**- Weak (1), Medium (2), Strong (3)

***Collar girth**- It is measured at 4.5 feet (1.4 m) above ground level.

Tree Photographs (with leaf):

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

Tree Photographs (without leaf):

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

3. Leaf and Flower

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf blade shape									
Leaf blade length									
Leaf blade width									
Flowering Intensity									
Flower color									
Regularity of flowering									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Sex expression of flowers									
Inflorescence type									

***Leaf blade shape** - Elliptic (1), Ovate (2), Obovate (3)

***Flowering Intensity** - Sparse (1), Medium (2), Dense (3)

***Flower color** - Yellow (1), Creamy Yellow (2)

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

***Sex expression of flowers** - Female only (1), Female and male (1), Female, male and hermaphrodite (3)

***Inflorescence type** - Solitary (1), Cymose (2)

4. Fruit:

For the observations on the fruit, 10 typical fruits should be selected out of 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.

Parameters	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Precocity of fruit bearing									
Average number of seed									
Fruit Size									
Fruit Shape in lateral view									
Presence of brown specks in flesh									
Size of brown speck in flesh									
Fruit shape in cross section									
Color of fruit skin									

Parameters	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Seed Size									
Seed Shape									
Seed Color									
Average fruit weight									
Productivity (Kg/tree)									

***Precocity of fruit bearing** - Early (1), Medium (2), Late (3)

***Fruit/Seed Size:** Small (1), Medium (2), Large (3)

***Fruit Shape in lateral view** - Oblate(1), Elliptic(2), Ovate (3), Circular (4)

***Presence of brown specks in flesh** - Always Absent (1), Sometimes present(2), Always present(3)

***Size of brown speck in flesh** - Small (1), Medium(2), Large(3)

***Fruit shape in cross section** - Circular (1), Irregular rounded (2), Square (3)

***Color of fruit skin** - Yellow-orange (1), Orange (2), Orange-red (3), Dark purple (4)

* **Seed Shape:** Eliptic (1), Ovate (2), Broad ovate (3), Narrow reniform (4), Broad reniform (5)

***Seed Color:** Green-brown (1), Medium brown (2), Dark brown (3).

Sample fruit photographs

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
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Photographs of fruit hanging on the tree

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

5. Fruit quality

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Fruit firmness									
Fruit astringency									

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Remarks
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Skin thickness									
Flesh sweetness									
Fruit storage life (days)									

***Fruit firmness** is classified as 1- Firm (≥ 2 kg), 2- Medium (1.4 - 1.9 kg) and 3- Soft (≤ 1.3 kg)

***Skin thickness** is found out through visual observation as 1- Thick, 2-Medium and 3- Thin

***Flesh sweetness** is measured through refractometer in brix %

* **Fruit astringency:** Always absent, irrespective of presence of seed (1), Always present, irrespective of presence of seed (2), Presence depending on presence and number of seeds (3).

6. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Remarks
Example : Root rot		3	2	8	6	
1	Oriental fruit fly					
2	Leaf spot					
3	Root rot					
4	Stem borer					
5	Twig dieback					

*Disease and pests should be scored in 1-9 scale where; 1 refers to no visible symptoms to 9 as maximum infection with more than 50% incidence and more than 75% severity. 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.

References

UPOV, WORKING PAPER ON DRAFT TEST GUIDELINES FOR PERSIMMON (2002). INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS.

Guan, C., Che, Q., Zhang, P., Huang, J., Chachar, S., Ruan, X., ... & Yang, Y. (2021). Codification and description of growth stages in persimmon (*Diospyros kaki* Thunb.) using the extended BBCH scale. *Scientia Horticulturae*, 280, 109895.

Yuniastuti, E., Saputro, M. A. A., & Delfianti, M. N. I. (2021, July). Characterization of persimmon (*Diospyros kaki* L.) as biodiversity originated from Indonesia. In *IOP Conference Series: Earth and Environmental Science* (Vol. 824, No. 1, p. 012040). IOP Publishing.

Kiwifruit (*Actinidia Spp.*) Genetic Resources Characterization and Evaluation Datasheet



National Center for Fruit Development (NCFD)

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Web: www.ncfd.gov.np

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- c) Presence/absence of characters are scored as + (present) and 0 (absent);
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- e) When the descriptor is inapplicable, '0' is used as the descriptor value. For example, if an accession does not form flowers, a '0' would be scored for the following descriptor.

Flower color

1. White
 2. Yellow
 3. Red
 4. Purple
- f) Blanks are used for information not yet available;
 - g) Passport data is the prerequisite before characterizing and evaluating the genetic resources;

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. 10°30'S)
8. Longitude of collection site:
(Degrees and minutes followed by E (east) or W (west), e.g. 76°25'W)
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. 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))
16. 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)
- 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, minimum of five plants should be sampled per accession.

1. Principal Phenological Growth Stages

The principal growth stages of kiwifruit according to BBCH scale are as mentioned below;

BBCH code	Growth stage description	Observed date					Remarks
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	
Principal growth stage 0: Bud development							
00	Dormant buds grown in the previous crop-year are completely closed. A small ostiole (less than 2mm in diameter) is visible.						
01	Beginning of bud swelling; scales just visible. For <i>A. deliciosa</i> and <i>A. chinensis</i> they are covered by white trichomes						
03	End of bud swelling; scales protruded through the corky tissue of the stem. For <i>A. deliciosa</i> and <i>A. chinensis</i> scales are densely covered by brown trichomes on their abaxial surface. For <i>A. arguta</i> scales tips joined apically.						
07	Beginning of bud burst. For <i>A. deliciosa</i> and <i>A. chinensis</i> , leaf and inflorescence buds enclosed by scales covered by brown trichomes. For <i>A. arguta</i> scales tips dispersed along bud axis						
09	Scales separated and green leaf tips are visible. For <i>A. deliciosa</i> and <i>A. chinensis</i> they are covered by brown trichomes, for <i>A. arguta</i> they are covered abxially by white ones.						
Principal growth stage 1 : Leaf development							
10	Bud develops into green cluster of few visible leaves						
11	Visible leaves unfolded and start spreading away from the shoot						
12-18	2-8 or more leaves are unfolded but not at full size						
19	First leaves completely developed						
Principal growth stage 3 : Shoot development							
31	Shoots reach about 10% of final length						
32	Shoots reach about 20% of final length						
35	5 Shoots reach about 0% of final length						
39	Shoots reach about 90% of final length						
Principal growth stage 5 : Inflorescence emergence							
51	Inflorescence bud swelling (flowers borne as singlets or triplets in the leaf axils). Buds closed, with no peduncle, greenish sepals visible covered by trichomes.						

BBCH code	Growth stage description	Observed date					Remarks
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	
53	Flower buds growing, they still closed, reddish peduncle elongating						
55	Sepals begin to separate. A white greenish corolla starts to be visible, reddish peduncles continue to elongate.						
56	Sepals continue to separate, and peduncles to elongate and thicken. Corolla clearly visible, longer than calyx, changes color from white greenish to white.						
57	Corolla at balloon stage, first flowers with white petals forming a hollow ball. One of the petals separates from the rest.						
59	Several petals separate, pistil still not visible longer than calyx						
Principal growth stage 6 : Flowering							
60	First flower open, Corolla bell shaped, pistil visible.						
61	Beginning of flowering: 10% flower open						
65	Full flowering : at least 50% flower open						
67	First petal fading or falling. Some pistils still fertile						
68	Most petals dry or fallen. All pistils dry and no longer functional.						
69	End of flowering, fruit set visible						
Principal growth stage 7 : Fruit development							
71	Fruit about 10% of final size showing the typical characteristics of cultivars.						
73	Fruit about 20% of final size						
75	Fruit about 50% of final size						
79	Fruit about 90% of final size						
Principal growth stage 8 : Maturity of fruit							
81	Seeds reach their full size, harden and change color from white to brown, progressing through tan to dark brown.						
85	Fruit ripe for commercial picking, solids content higher than 6.2%. Seed color becomes black. Fruit at physiological maturity (not suitable for consumption), begins to soften.						
89	Fruit fully ripe for consumption: fruit has typical taste, flavor and firmness. Soluble solids about 14 to 16%.						
Principal growth stage 9 : Senescence, Beginning of dormancy							
91	Shoot growth complete; foliage fully dark green						

BBCH code	Growth stage description	Observed date					Remarks
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	
93	Beginning of senescence of old leaves; leaves fall i.e. Starting of leaf fall						
97	All leaves fallen i.e. Completion of leaf fall, Winter rest period.						

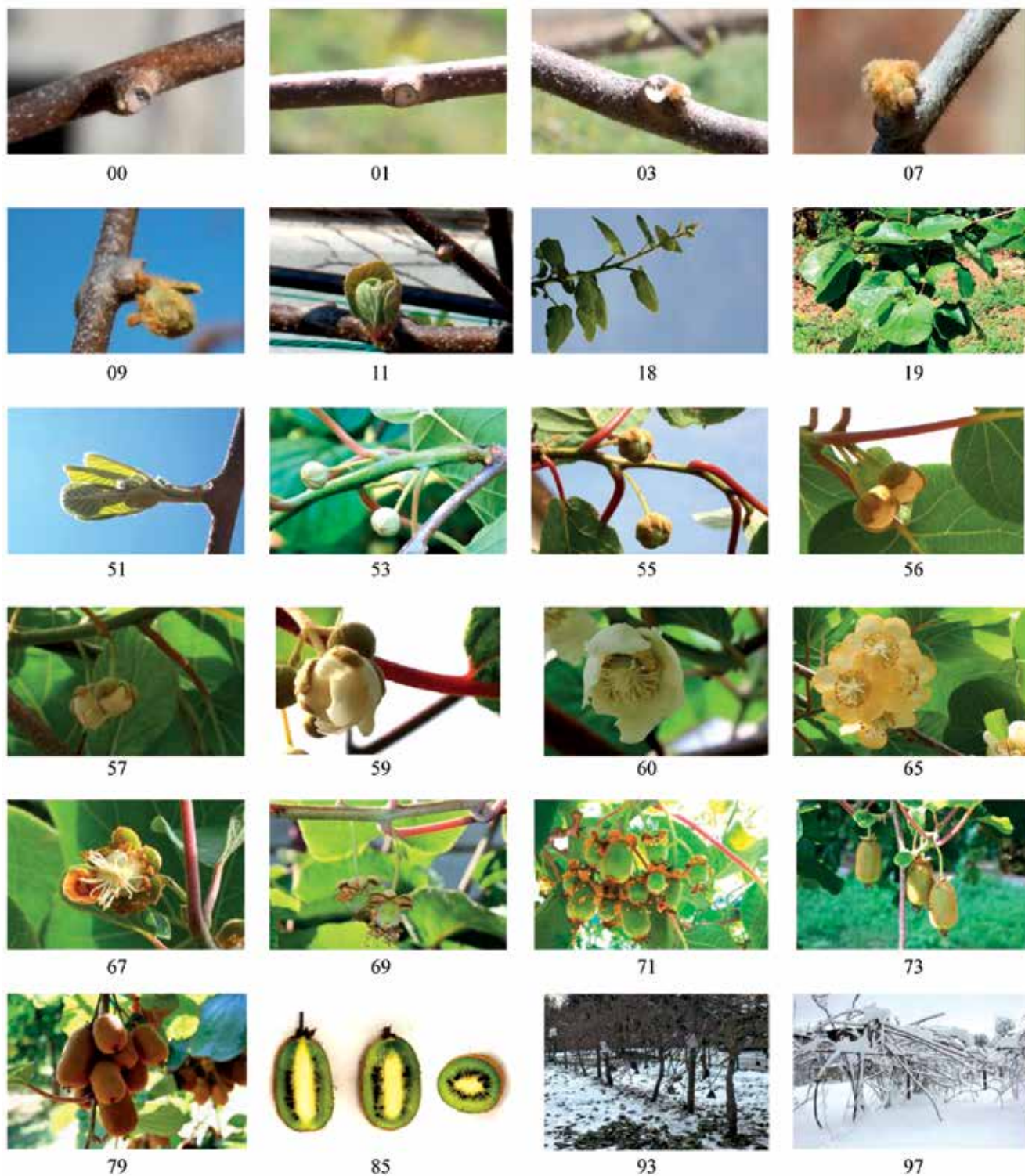


Figure 1: Some phenological growth stages of Bruno variety of kiwi fruit (*Actinidia deliciosa*) according to BBCH scale.

2. Tree:

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Plant type											Female – Hayward Male - Matua
Growth habit											
Fruit Bearing habit											
Plant vigor											Medium (Hayward)
Bark Texture											Very rough (Hayward)
Collar girth (cm)											
Canopy diameter (m)											

***Plant type** : Female (1), Male (2), Hermaphrodite (3)

***Growth habit** : Vines (1), Others (2- Specify)

***Fruit Bearing habit** : Spur (1), Old branches (2), One year old shoot (3), On new shoots (4)

***Plant vigor**: Weak (3), Medium(5), Strong(7), Very Strong (9)

***Bark Texture** : Smooth (1), Moderately rough (2), Very rough (3)

Tree Photographs (with leaf):

Sample 1 Photo	Sample 2 Photo
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<p>Sample 3 Photo</p>	<p>Sample 4 Photo</p>
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Tree Photographs (without leaf):

<p>Sample 1 Photo</p>	<p>Sample 2 Photo</p>
<p>Sample 3 Photo</p>	<p>Sample 4 Photo</p>

3. Stem

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Density of hairs on young shoot											Medium - Hayward
Anthocyanin coloration of growing tip of young shoot											
Thickness of one year old shoot											Medium – Hayward Thick - Bruno
Number of lenticels on stem											Medium – Hayward Many- Bruno
Presence of bud cover											Present - Hayward
Size of hole in bud cover											Small- Abbott Medium- Hayward
Stem pith											Lamellate - Hayward

***Density of hairs on young shoot:** Very sparse (1), Sparse (3), Medium (5), Dense (7)

* **Anthocyanin colouration of growing tip of young shoot:** Absent or very weak (1), Weak (3), Medium (5), Strong (7)

***Thickness of one-year-old shoot:** Thin (1), Medium (2), Thick (3)

***Number of lenticels on stem:** Few (3), Medium (5), Many (7)

***Presence of bud cover on stem:** Absent (1), Present (9)

***Size of hole in bud cover:** Small (1), Medium (2), Large (3)

***Stem pith:** Absent (0), Lamellate (1), Solid (2)

4. Leaves

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Leaf blade shape of apex											Acute - Hayward
Leaf blade/ Leaf shape											Ovate – Hayward Obovate - Bruno

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Length/ Width ratio of leaf blade											Low – Matua Hayward – Low to medium Bruno - Medium
Leaf blade basal lobe											Slightly apart – Matua Slightly overlapping - Hayward
Intensity of green colour on upper side of leaf blade											Medium – Hayward Dark- Bruno
Leaf blade colour on lower side											Medium green – Bruno Yellow green - Hayward
Length of petiole											

***Leaf blade shape of apex:** Caudate (1), Acuminate (2), Acute (3), Rounded (4), Retuse (5), Emerginate (6)

***Leaf shape/Leaf blade shape:** Lanceolate (1), Ovate (2), Obovate (3)

***Length/ Width ratio of leaf blade :** Very low (1), Very low to low (2), Low (3), Low to medium (4), Medium (5), Medium to high (6), High (7), High to very high (8), Very high (9)

***Leaf blade basal lobes:** None (1), Far apart (2), Slightly apart (3), Touching each other (4), Slightly overlapping (5) Strongly overlapping (6)

***Intensity of green colour on upper side of leaf blade:** Light (3), Medium (5), Dark (7)

***Leaf blade colour on lower side:** Whitish (1), Light green (2), Medium green (3), Yellow green (4), Yellow brown (5)

5. Flower

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Flowering Intensity											
Inflorescence type											
Number of flowers in inflorescence											Very few (Hayward) Few (Matua)
Flower color											

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Arrangements of petals											Free : Abbott Touching : Matua Overlapping : Hayward
Length of sepals											
Length of petal											
Flower diameter											
Position of stigma in relation to Stamens											
Regularity of flowering											

***Flowering intensity:** No flower (1)-Absence of any flower, Extremely Low (2)- Flower clusters represent up to 5% of all buds, Low (3) - Flower clusters represent approx 10% of all buds, Low to Medium (4)- X, Medium (5) - Flower cluster represents approx. 30% of all bud, Medium to high (6) – X, High (7) – Flower clusters represents approx 50% of all bud, High to extremely high (8)- X, Extremely high (9) –Over 90% of all buds are floral. Where, X : Intermediate rating

* **Inflorescence type:** Solitary (1), Dichasium (2), Pleoichasium (3)

* **Number of flowers in inflorescence (Specify the number):** Very few (1), Few (2), Medium (3), Many (4)

* **Flower color:** White (1), Greenish white (2), Yellowish white (3), Yellowish green (4), Yellow (5)

* **Arrangement of petals:** Free (1), Touching (2), Overlapping (3)

* **Position of Stigma in relation to stamens:** Below (1), Same level (2), Above (3)

* **Regularity of flowering:** Very often irregular/Biennial (1), Intermediate behavior (2), Very often regular (3)

Sample photographs of flowers

Sample 1 Photo	Sample 2 Photo
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Sample 3 Photo	Sample 4 Photo
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6. Fruit

Parameters	Sample 1		Sample 2		Sample 3		Sample 5		Sample 4		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Precocity of fruit bearing											
Abundance of seed											
Length of fruit											
Width of fruit											
Length/Width ratio of fruit											
Fruit shape											Elliptic (Hayward)- Obovate - Monty
Regularity of fruit shape											
Fruit shape in cross section											Circular – Bruno Transverse elliptic - Hayward
General shape of core in cross section											

Parameters	Sample 1		Sample 2		Sample 3		Sample 5		Sample 4		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Width of core relative to cross section											Medium – Brunno Large - Hayward
Colour of core											Greenish white (Hayward)
Styler end											Flat-Hayward
Degree of pointed protrusion											
Presence of calyx ring											Medium - Hayward
Shape of shoulder at stalk end											Weakly slopping - Hayward
Length of stalk											
Color of fruit skin at maturity											Greenish brown - Hayward
Hairiness of fruit skin at maturity											Absent : Red kiwi Present : Hayward
Density of hairs on fruit skin at maturity											Medium - Hayward
Color of outer pericarp											Medium green - Hayward
Color of locules											Medium green - Hayward
Presence of reddish color in locules											
Intensity of reddish colour in locules											

Parameters	Sample 1		Sample 2		Sample 3		Sample 5		Sample 4		Reference varieties
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail	
Average fruit weight (gm/fruit)											
Productivity (Kg/tree)											

***Precocity of fruit bearing:** Extremely low (1), Low (2), Intermediate (3), High (4), Extremely high (5)

* **Abundance of seed:** Low (3), Intermediate (5), High (7)

* **Fruit Shape:** Ovate (1), Oblong (2), Elliptic (3), Circular (4), Oblate (5), Obovate (6)

***Regularity of shape:** Regular shape (1), Slightly variable shape (2), Highly variable shape (3)

* **Fruit shape in cross section:** Circular (1), Oblate (2), Transverse elliptic (3)

* **General shape of core in cross section:** Circular (1), Oblate (2), Transverse elliptic (3)

***Width of core relative to cross section:** Small (3), Small to medium (4), Medium (5), Medium to large (6), Large (7)

***Colour of core:** White (1), Greenish white (2), Yellow white (3), Red purple (4)

*Styler end: Strongly depressed (1), Weakly depressed (2), Flat (3), Rounded (4), Weakly blunt protruding (5), Strongly blunt protruding (6), Pointed protrusion (7)

* **Degree of pointed protrusion:** Weak (1), Medium (2), Strong (3)

* **Presence of calyx ring:** Absent or weakly expressed (1), Medium expressed (2), Strongly expressed (3)

***Shape of shoulder at stalk end:** Truncate (1), Weakly slopping (2), Strongly slopping

* **Length of stalk:** Short (1), Medium (2), Long (3)

* **Color of fruit skin:** Light green (1), Medium green (2), Reddish green (3), Yellow (4), Greenish Brown (5), Reddish Brown (6), Light brown (7), Medium brown (8), Dark red (9), Purple red (10)

* **Hairiness of skin:** Absent (1), Present (9)

***Density of hairs on fruit skin:** Very sparse (1), Sparse (3), Medium (5), Dense (7)

***Colour of outer pericarp:** Light green (1), Medium green (2), Dark green (3), Greenish Yellow (4), Medium Yellow (5), Dark Yellow (6), Yellowish orange (7), Orange (8), Red (9), Red purple (10)

***Colour of locules:** Light green (1), Medium green (2), Dark green (3), Greenish Yellow (4), Medium Yellow (5), Dark Yellow (6), Red (7), Red purple (8)

* **Presence of reddish colour in locules:** Absent (0), Present (1)

* **Intensity of reddish colour in locules:** Light (3), Medium (5), dark (7)

Photographs of sample fruit after harvesting:

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

7. Fruit quality

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Fruit firmness										
Skin thickness										
Flesh sweetness										
Flesh acidity										
Ratio between acidity and sweetness										

Parameter	Sample 1		Sample 2		Sample 3		Sample 4		Sample 5	
	Code	Detail	Code	Detail	Code	Detail	Code	Detail	Code	Detail
Flesh Juiciness										
Intensity of fruit aroma										
Presence of Water soaked flesh tissue during storage										
Storage life										
Overall quality of fruit										

***Fruit firmness:** Measured during harvesting and after harvesting, Fruit firmness can be measured either by using a penetrometer or by sensory analysis.

***Skin thickness:** Thin (3), Medium (5), Thick (7), measured by sensory assessment.

***Flesh sweetness / Acidity / Ratio :** Measured during harvesting and after harvesting

***Flesh Juiciness / Intensity of fruit aroma :** Low (3), Medium (5), High (7)

* **Water soaked flesh tissue in ripened fruit:** Absent (0), low (3), Medium (5), High (7)

* **Fruit storage life (Specify the storage condition):** Short (3), Intermediate (5), Long (7)

* **Over all fruit quality:** Extremely poor (1), Very poor (2), Poor (3), Poor to good (4), Good (5), Good to very good (6), Very good (7), Extremely good (9)

8. Disease and pest susceptibility

S.N.	Disease and Pests	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Example : Thrips		3	2	8	6	9
1	Phytophthora root rot					
2	Leaf spot					
3	Botrytis fruit rot					
4	Stem borer					
5	Root knot nematode					
6	Mites					
7	Thrips					

*Disease and pests should be scored in 1-9 scale where; 1-3 refers to low susceptibility. 4-6 refers to intermediate and 7-9 as high susceptibility.

NOTES:

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

References:

1. ILIESCU, Mihaela Lavinia and STANICA, Florin, 2020. KIWIFRUIT (ACTINIDIA SPP.) PHENOLOGICAL GROWTH STAGES IN SOUTHERN ROMANIAN CLIMATE ACCORDING TO THE BBCH SCALE .
2. Paudyal, K. P. (2013, March). Characterization and Variety Selection of Kiwifruit (Actinidia spp.) in Nepal. In *Proc. Eighth National Horticulture Seminar on Horticulture Development towards the Pace of National Economic Growth, Khumaltar, Kathmandu* (pp. 18-20).
3. UPOV, 2012. Actinidia: Guidelines for the conduct of tasks for Distinctness, Uniformity and Stability. International Union for the protection of new varieties of plants, Geneva, Switzerland. Available at <https://www.upov.int/edocs/tgdocs/en/tg098.pdf>.