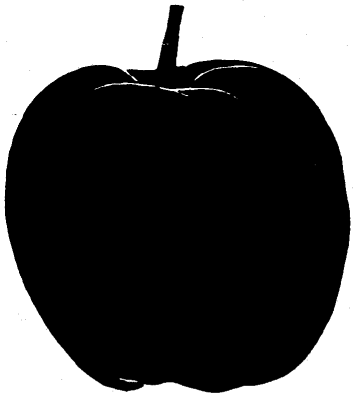

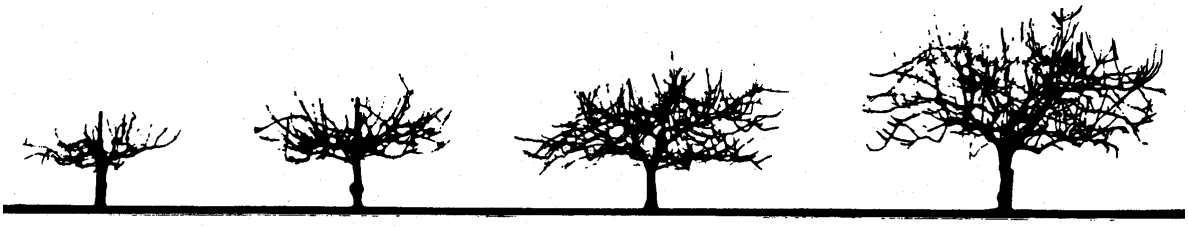

APPLE
DESCRIPTORS

INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

COMMISSION OF EUROPEAN COMMUNITIES: COMMITTEE ON DISEASE RESISTANCE BREEDING AND USE OF GENEBANKS

DESCRIPTOR LIST FOR APPLE (MALUS)

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CEC Secretariat, Brussels, 1982

IBPGR SECRETARIAT, Rome, 1982
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In 1974 the Council of Ministers of the European Communities established a Standing Committee on Agricultural Research to advise the Commission on a programme of Agricultural Research.

The first programme started in 1975, while a second programme was launched in 1979 for the five year period 1979-1983.

The Standing Committee on Agricultural Research has advised the Commission on both programmes. Within this framework a programme on resistance breeding and use of genebanks has been set-up as one of 10 subjects. This programme (with a limited budget) is managed by a programme committee in which the ten member countries are represented by their nominees, one per country. The programme committee started work in 1978 by selecting priorities for crops and subjects. Several working groups have been set-up to prepare descriptor lists as a basis for future work.

CEC-Programme Committee on Disease Resistance Breeding and Use of Genebanks
Second Programme on Agricultural Research of the CEC

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The International Board for Plant Genetic Resources (IBPGR) is an autonomous, international, scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR). The IBPGR, which was established by the CSIAR in 1974, is composed of its Chairman and 15 members; its Executive Secretariat is provided by the Food and Agriculture Organization of the United Nations. The basic function of the IBPGR, as defined by the Consultative Group, is to promote an international network of genetic resources contras to further the collection, conservations documentations evaluation and use of plant germplasm and thereby contribute to raising the standard of living and welfare of people throughout the world. The Consultative Group mobilizes financial support from its members to meet the budgetary requirements of the Board.

IBPGR Executive Secretariat
Crop Genetic Resources Centre
Plant Production and Protection Division
Food and Agriculture Organization of the United Nations
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CONTENTS

PREFACE

The apple descriptor list was initiated and developed with full support from the Commission of the European Communities (CEC) Programme Committee for Plant Disease Resistance Breeding and the Use of Genebanks - Apple Genetic Resources Scheme by R. Watkins (Apple Co-ordinator) in collaboration with R.A. Smith following consultation involving representatives of the USA National Plant Germplasm System (NPGS), the Canadian Plant Gene Resources Program, M. Iizuka for Japan, and the International Board for Plant Genetic Resources (IBPGR). The UPOV descriptor list for apples was studied and common systems were used where possible.

This descriptor list has been prepared to the IBPGR standard format following advice on descriptors and descriptor states from the crop experts throughout the world (see Appendix I). The IBPGR encourages the collection of data on the first four categories of this list: 1. Accession; 2. Collection; 3. and 4. Characterization and preliminary evaluation. The IBPGR endorses the information in categories 1-4 as the minimum that ideally should be available for any one accession. Other descriptors are given in categories 5 onwards that will enable the simple encoding of further characterization and evaluation data and which can serve as examples for the creation of additional descriptors in the IBPGR form by any user.

Although the suggested coding should not be regarded as the definitive scheme, this format has the full backing of the IBPGR and is promoted worldwide. The descriptor list given here provides an international format and thereby produces a universally understood 'language' for all plant genetic resources data. The adoption of this scheme for all data encoding, or at least the production of a transformation method to convert other schemes to the IBPGR format, will produce a rapid, reliable and efficient means for information storage, retrieval and communication. This will greatly assist the utilization of germplasm throughout the international plant genetic resources network. It is recommended, therefore, that information should be produced by closely following this descriptor list with regard to: ordering and numbering descriptors; using the descriptors specified; and using the descriptor states recommended.

Errors and omissions are the responsibility of the editors.
Any suggestions for modifications will be welcomed by the IBPGR Secretariat, Rome, and by editors, especially new descriptors.

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November 1982

DESCRIPTOR LIST FOR APPLE

The IBPGR now uses the following definitions in genetic resources documentation:

i) passport data (accession identifiers and information recorded by collectors);

ii) characterization (consists of recording those characters which are highly heritable, can be easily seen by the eye and are expressed in all environments);

iii) preliminary evaluation (consists of recording a limited number of additional traits thought desirable by a consensus of users of the particular crop)

Characterization and preliminary evaluation will normally be the responsibility of the curators, while further characterization and evaluation should normally be carried out by the plant breeder. Data from further evaluation should be fed back to the crop co-ordinator who will maintain a data file.

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 10' 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) 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, 11.

For the observations on the fruit, 10 typical fruits should be selected out of a minimum of 20 from two 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.

PASSPORT

1. ACCESSION DATA

INTRODUCTORY

1.1 ACCESSION NUMBER (at site)

A site may choose to use a Genetic Research Scheme (GRS) ACCESSION NUMBER (see 1.4) as the only unique identifer; letters should occur before the number to identify the genebank or national system (e.g. PI indicates an accession within the USA system, and EC indicates an accession within the CEC Fruit Genetic Resources Scheme). If, however, a SITE ACCESSION NUMBER is also used, this number serves as a unique identifier for an accession at a given site and is assigned by the curator of a particular genebank site when an accession is entered into the site genebank. It must not be re-used even if the accession is lost

1.2 DONOR NAME (= Source of acquisition)

The name and address of the person or institute responsible for donating the germplasm to the genebank collection at the site (see 1.13) at which the plants are held

1.3 DONOR IDENTIFICATION NUMBER

The number (or name) assigned by the person or institute above (1.2) donating the accession to the site specified at 1.13

1.4 OTHER NUMBERS ASSOCIATED WITH THE ACCESSION (see also 1.17 and 2.1)

Any other identification number known to exist in other collections for this accession, e.g. CEC Genetic Resources Scheme *(EC) number or United States Plant Inventory (PI) number. EC and PI numbers serve as unique identifiers for an accession in a particular GRS, and must not be re-used; they are assigned by the EC or PI co-ordinator, and not by the site curator.

1.4.1 *EC number (CEC GRS accession number)

1.4.2 PI number (United States Plant Inventory accession number)

1.4.3 etc. Other code numbers allocated in consultation with the editors and IBPGR

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* Basic EC Apple Descriptors

1.5 SCIENTIFIC NAME (Use Malus pumila for the cultivated apple)

1.5.1 *Genus e.g. Malus

1.5.2 *Species e.g. sylvestris

1.5.3 *Subspecies (if applicable) e.g. paradisiaca (for Paradise or Doucin)

1.6 PEDIGREE OF ACCESSION

1.6.1 *Female parent (of the accession)

1.6.2 *Male parent

1.6.3 Mother of female parent

1.6.4 Father of female parent

1.6.5 Mother of male parent

1.6.6 Father of male parent

1.6.7 Nomenclature and designations

Identities and additional pedigree assigned to breeder's material

1.7 ACQUISITION DATE

The month and year in which the accession entered the collection, expressed numerically, e.g. June = 06, 1981 = 1981

1.7.1 Month

1.7.2 Year

1.8 DATE OF LAST REGENERATION OR MULTIPLICATION

The month and year expressed numerically, e.g. October = 10, 1978 = 1978

1.8.1 Month

1.8.2 Year

1.9 ACCESSION SIZE

Approximate number of seeds or plants of accession in collection

1.10 NUMBER OF TIMES ACCESSION REGENERATED

Number of regenerations or multiplications since original collection

1.11 TYPE OF MAINTENANCE

1 Vegetative
2 Seed
3 Pollen
4 Tissue culture
5 More than one method (specify in NOTES descriptor, 11)

SITE SPECIFIC

1.12 *COUNTRY WHERE MAINTAINED

Code letters for country in which plants are grown. Use the three letter abbreviations supported by the Statistical Office of the United Nations. Copies of the abbreviations are available from the IBPGR Secretariat and have been published in the FAO/IBPGR Plant Genetic Resources Newsletter No. 49

e.g. CAN Canada
DNK Denmark
GRC Greece
JPN Japan

1.13 *SITE WHERE MAINTAINED

Code letters for institute at which genebank plants are grown. These must be unique for a particular country and, to avoid duplication, should be agreed by IBPGR

e.g. ANG Station de Recherches d'Arboriculture Fruitiere, Angers

EMRS East Malling Research Station, Kent

FIR Istituto di Coltivazioni Arboree, Florence

NFTB National Fruit Trials, Brogdale, Kent

1.14 CURATOR

The officer responsible for maintaining the genetic resources material held at the site specified above

1.15 *LOCAL NAME

The name by which the cultivar or species is listed at the above site. This may be either some combination of the Genetic Identifiers (1.20 and 1.21) or a synonym.

1.16 *LOCAL CLONE/MUTANT/VARIANT NAME

The clone or mutant name of the cultivar or species (if any) by which it is identified at the above site. This may be either the internationally accepted name (1.21) or a synonym.

1.17 LOCAL PLANT NUMBER

This identifies a single plant within a population of plants having the same site accession number. It may be any combination of plot identity, row number, and tree position within the row

1.18 DISTRIBUTION LIMITED

0 = No
+ = Yes -specify restrictions in the NOTES descriptor, 11

1.19 YEAR OF PROBABLE DISCARD

Enter year that the accession will probably be discarded, e.g. 1983

FURTHER IDENTIFIERS

1.20 *GENETIC NAME

The name of the cultivar or species as internationally accepted or defined by the Genetic Resources Scheme co-ordinator, e.g. Delicious

1.21 *GRS CLONE/MUTANT/VARIANT NAME

The internationally accepted name (if any) of the clone or mutant of the cultivar or species, e.g. Starking

1.22 PATENT NUMBER (or Plant Variety Rights number)

Patented cultivars -record the patent number or, if the patent number is not known write '+'

Non-patented cultivars - record as '0'

1.23 SYNONYMS

Other useful names (excluding those occurring above) in alphabetical order

2. COLLECTION OF DATA

2.1 COLLECTOR'S NUMBER

Original number assigned by collector of the sample normally composed of the name or initials of the collector(s) followed by a number. This item is essential for identifying duplicates held in different collections and should always accompany sub-samples wherever they are sent.

2.2 COLLECTING INSTITUTE

Institute or person collecting/sponsoring the original sample

2.3 DATE OF COLLECTION OF ORIGINAL SAMPLE

Expressed numerically, e.g. March = 03, 1980 = 1980

2.3.1 Month

2.3.2 Year

2.4 *COUNTRY OF COLLECTION OR COUNTRY WHERE CULTIVAR / VARIETY BRED (=Origin)

Use the three letter abbreviations supported by the Statistical Office of the United Nations (see 1.12).

2.5 PROVINCE / STATE

Name of the administrative subdivision of the country in which the sample was collected

2.6 LOCATION OF COLLECTION SITE

Number of kilometers and direction from nearest town, village or map grid reference (e.g. TIMBUKTU7S means 7km South of Timbuktu)

2.7 LATITUDE OF COLLECTION SITE

Degrees and minutes followed by N (north) or S (south), e.g. 1030S

2.8 LONGITUDE OF COLLECTION SITE

Degrees and minutes followed by E (east) or W (west), e.g. 7625W

2.9 ALTITUDE OF COLLECTION SITE

Elevation above sea level in meters

2.10 COLLECTION SOURCE

1 Wild
2 Farm land
3 Farm store
4 Backyard
5 Village market
6 Commercial market
7 Institute
8 Other (specify in the NOTES descriptor, 11)

2.11 STATUS OF SAMPLE

1 Wild
2 Weedy
3 Breeder's line
4 Primitive cultivar / landrace
5 Advanced cultivar (bred)
6 Other (specify in the NOTES descriptor, 11)

2.12 LOCAL/VERNACULAR NAME

Name given by farmer to cultivar/landrace/weed

2.13 NUMBER OF PLANTS SAMPLED

Approximate number of plants collected (sampled) in the field to produce this accession

2.14 PHOTOGRAPH

Was a photograph taken of the accession or environment at collection?

0 = No
+ = Yes

2.15 TYPE OF SAMPLE

1 Vegetative

2 Seed

3 Both

2.16 NATURE OF VEGETATIVE SAMPLE

0 Not vegetative (seed)
I Cuttings - for grafting
2 Cuttings - for rooting
3 Rooted plants
4 Tissue culture
5 Other (specify in the Notes, descriptor, 11)

2.17 *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 descriptor, 11 (positive or negative)

2.18 *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 (pollinizor)
8 Botanical (wild) species
9 Other (specify in the NOTES descriptor, 11)

2.19 OTHER NOTES FROM COLLECTOR

Collectors will record ecological/climatic information. For cultivated crops, cultivation practices will be recorded

CHARACTERIZATION AND PRLIMANARY EVALUATION DATA

3. SITE DATA

3.1 COUNTRY OF CHARACTERIZATION AND PRELIMINARY EVALUATION See 1.12 for code

3.2 SITE (RESEARCH INSTITUTE)

See 1.13 for coding procedure

3.3 NAME OF PERSON IN CHARGE OF CHARACTERIZATION

3.4 ROOTSTOCK

Name of rootstock on which accession is grafted (if any)

3.5 CONDITION OF 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

4. PLANT DATA

4.1. VEGETATIVE

4.1.1 *Propagation method

Suitable method(s) employed for multiplication (0 = No, + = Yes)

4.1.1.1 Grafting (including budding)

4.1.1.2 Hardwood cuttings

4.1.1.3 Softwood cuttings

4.1.1.4 Stool beds

4.1.1.5 Layering

4.1.1.6 Micropropagation

4.1.1.7 Seed

4.1.1.8 Other (specify in NOTES descriptor, 11)

4.1.2 *Chromosome number

4.2 INFLORESCENCE AND FRUIT

4.2.1 *Harvest maturity (Season mature to pick)

	Reference
1 Extremely early	White Transparent, Jerseymac, Close
2 Very early	Discovery
3 Early	Paulared, Tydeman's Early Worcester
4 Early/mid-season	James Grieve
5 Mid-season	Cox's Orange Pippin
6 Mid-season/late	Delicious, Golden Delicious
7 Late	N. Spy, Blaxtayman, Jonagold
8 Very late	Glockenapfel
9 Extremely late	Rome Beauty, Granny Smith

4.2.2 *Maximum storage life

Information on best commercial storage conditions

4.2.2.1 Maximum number of days stores well under the conditions specified in 4.2.2.2 to 4.2.2.6

4.2.2.2 Air storage

0 = No
+ = Yes

4.2.2.3 Temperature C

4.2.2.4 Percentage oxygen

4.2.2.5 Percentage carbon dioxide

4.2.2.6 Percentage humidity

4.2.3 Number of locules

Typical number of locules in fruit

4.2.4 Persistency of calyx

+ = Persistent in mature fruit
0 = Absent in mature fruit

FURTHER CHARACTERIZATION AND EVALUATION

5. SITE DATA

5.1 COUNTRY OF FURTHER CHARACTERIZATION AND EVALUATION

5.2 SITE (RESEARCH INSTITUTE)

5.3 NAME OF PERSON IN CHARGE OF EVALUATION

5.4 ROOTSTOCK

Name of the rootstock on which the accession is grafted (if any)

6. PLANT DATA

6.1 VEGETATIVE

SCIONS GRAFTED ON ROOTSTOCKS OR TREES ON THEIR OWN ROOTS

6.1.1 Tree habit (of branches)

Natural habit of an untrained, non-juvenile tree

	Reference
1 Extremely upright	de l'Estre, Wijcik McIntosh
2 Extremely upright/ upright	Gloster 69 upright
3 Upright	N. Spy, Spartan, Benoni
5 Spreading	Idared, Belle de Boskoop, Bramley's Seedling, Jonagold
6 Spreading/drooping	Cox's Orange Pippin, Elstar
7 Drooping	Golden Delicious
9 Weeping	Jonathan,Cortland Neild's Drooper, Exzellenz Thiel, Echtermeyer

6.1.2 Tree vigour

Based on height and spread measurements of adult trees on their own roots, or relative to reference cultivars on the same rootstock (use reference cultivars or species on a common rootstock for each site)

	Reference
1 Extremely weak	Discovery, Courtavel
3 Weak	Beauty of Bath, Lobo
5 Intermediate	Cox's Orange Pippin, Spartan, Golden Delicious
7 Vigorous	Gloster 69, Jonagold, Belle de Boskoop
9 Extremely vigorous	Mutsu (Crispin), Northern Spy

6.1.3 Scion / rootstock compatibility

The compatibility of a scion accession on the rootstock named in 5.4 or on other standard rootstocks (such as M.9 or MM.106, which if used should be recorded in NOTES descriptor, 11)

	Reference
3 Poor	
5 Intermediate	
7 Good	

ROOTSTOCKS AND / OR INTERSTOCKS (restricted to Malus)

6.1.4 Suckering tendency

The tendency of the rootstock to produce suckers (adventitious shoots) under normal field conditions

	Reference
0 Absent	M.16
1 Extremely low	M.26, M.27, Bud.9
3 Low	MM.106, Novole (M. x sublobata 286613)
5 Medium	MM.111
7 High	M.9
9 Extremely high	M.4, M.7, M.8

6.1.5 Burrknot tendency

	References
0 No burrknots	Novole
1 Very few burrknots	M. robusta 5
3 Few burrknots	M.27, Bud.57-490
5 Intermediate	M.71, MM.106
7 Many burrknots	M.2, M.9, M.26, MM.111
9 Very many burrknots	Bud. 54-146

6.1.6 Efficiency of mineral uptake

Measured on trees of a non-grafted rootstock sampled in mid-August. Each sample consisting of 8 leaves, taken from the middle portion of the current years extension growth. (Elements expressed as % dry matter)

6.1.6.1 Potassium (K)

	Reference
1 Extremely poor	M.26
3 Poor	M.8
5 Intermediate	M.9
7 Good	M.27
9 Extremely good	MM.104

6.1.6.2 *Calcium (Ca)

	Reference
1 Extremely poor	M.111
3 Poor	Northern Spy
5 Intermediate	M.2
7 Good	M. robusta 5
9 Extremely good	M.9

6.1.6.3 Magnesium (Mg)

	Reference
1 Extremely poor	MM.111
3 Poor	Northern Spy
5 Intermediate	M.25
7 Good	3426
9 Extremely good	-

6.1.7 *Dwarfing

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

	Reference
1 Extremely invigorating	M.12
2 Very invigorating	most seedlings
3 Invigorating	M.25, A2
4 Fairly invigorating	MM.111
5 Intermediate	MM.106
6 Semi-dwarfing	M.26, M.7, Ottawa 3
7 Dwarfing	M.9, Bud.9
8 Very dwarfing	M.27, Bud.57-491
9 Extremely dwarfing	3426

6.1.8 Yield efficiency

A high yield efficiency is defined as the induction in the scion of a high yield of fruit relative to the cross sectional area of the trunk

	Reference
1 Extremely poor	
2 Very poor	most seedlings
3 Poor	M.16
4 Poor/intermediate	M.111
5 Intermediate	MM.106
6 Intermediate/good	M.26
7 Good	M.9
8 Very good	M.27
9 Extremely good	3426

6.1.9 Best method of propagation

1 Hardwood cuttings

2 Softwood cuttings

3 Stool beds

4 Layering

5 Micropropagation

6 Seed

7 Easily propagated by more than one method (specify in the NOTES descriptor, 11)

8 Other (specify in the NOTES descriptor, 11)

6.1.10 Ease of Propagation

Using the method indicated above: Reference in Table 1

6.1.10.1 Hardwood cuttings

6.1.10.2 Softwood cuttings

6.1.10.3 Stool beds

6.1.10.4 Layering

6.1.10.5 Micropropagation

Table 1 Ease of propagation reference varieties

Propagation	6.1.10.1 Hardwood cuttings	6.1.10.3 Softwood cuttings	6.1.10.3 Stool Beds	6.1.10.4 Layering	6.1.10.5 Micropropagation
1 Extremely poor	Ottawa 3, Bud.9	Ottawa 3, Bud.9, M. 9	M. 20	--	--
3 Poor	M. 9	much apple material	M.2, M. 9	M. 2, M. 9	--
5 Medium	M. 2, M. 7	--	M. 27	M. 27	--
7 Good	M. 26, MM. 106	MM. 106, M. robusta 5	M. 7, M. 26	M. 7	M. 9, Cox, Bramely
9 Extremely good	Novole, Bud. 57- 490, M. prunifolia (Maruba – Kaido)	Novole	MM.106	M.7, M.26	M. 7, M. 26 Greensleeves

6.1.11 Anchorage

	Reference
3	Poor
5	Intermediate
7	Good

6.1.12 *Induction of precocious bearing in scions

		Reference
3	Poor	most seedlings
5	Intermediate	M.25
7	Good	M.9, M.27

6.2 INFLORESCENCE AND FRUIT

SCIONS

6.2.1 Season of flowering

Date of full flower

	Reference
1 Extremely early	Anna
2 Very early	Gravenstein
3 Early	Idared, Belle de Boskoop, Jerseymac
4 Early / intermediate	Mutsu (Crispin)
5 Intermediate	Cox's Orange Pippin, Spartan
6 Intermediate / late	Delicious, Golden Delicious
7 Late	'Malling' Suntan, Gloster 69, Northern Spy
8 Very late	Crawley Beauty, de Jaune
9 Extremely late	Spablunder Taffetapfel

6.2.2 Duration of flowering

In days (average of at least 4 years)

6.2.3 Regularity of Flowering

		Reference
1	Extremely irregular	
3	Irregular	Bancroft
5	Biennial	Most cultivars fall into one of these
7	Regular	categories
9	Extremely regular	

6.2.4 Secondary flowering

		Reference
1	Extremely rare	
3	Rare	
5	Intermediate	
7	Frequent	
9	Extremely frequent	

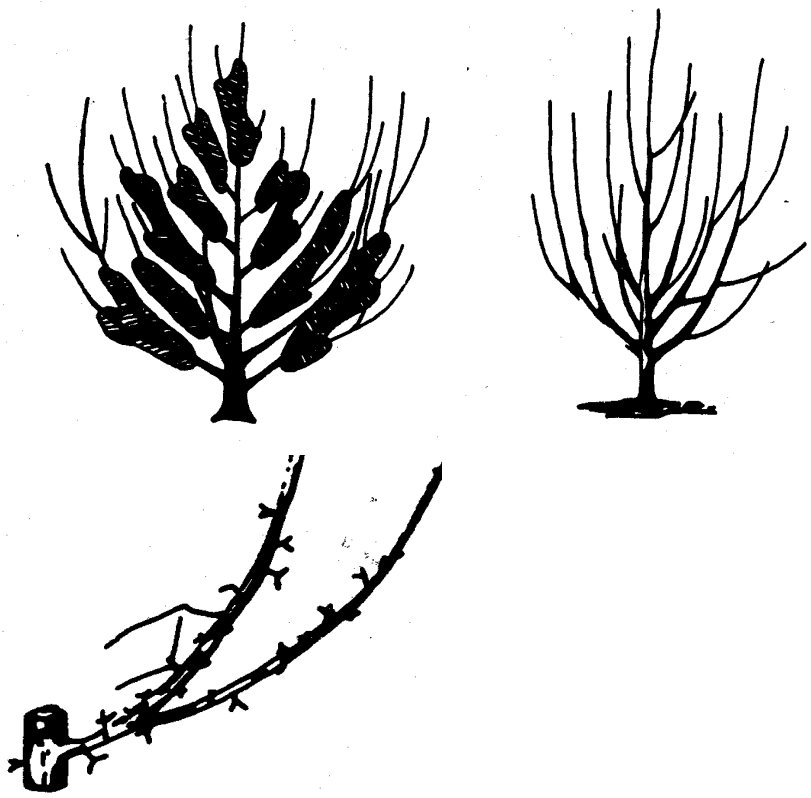
6.2.5 Self compatibility of flowers

		Reference
1	Incompatible	Delicious
2	Very poor	Cox's Orange Pippin, McIntosh
3	Poor	Golden Delicious, Grimes Golden
5	Intermediate	'Malling' Greensleeves, James Golden
7	Good	Lord Lambourne
8	Very good	Crawley Beauty, Benoni
9	Extremely good.	Tetraploids (not chimaeras)

6.2.6 Bearing habit

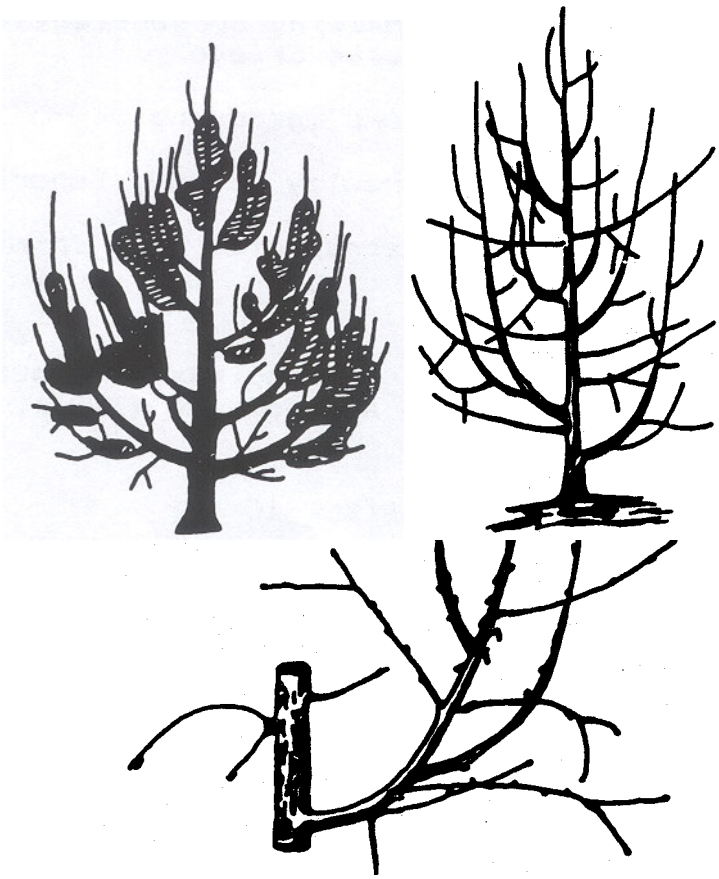
Based on the system used by Lespinasse - Institut National de la Recherche Agronomique (INRA), France. See Figure 1.

		Reference
1	Wijcik McIntosh	Wijcik mutant
3	INRA type.1	Starkrimson Delicious
5	INRA type II	King of the Pippins, Spartan, Cox's Orange Pippin
7	INRA type III	Golden Delicious
9	INRA type IV	Rome Beauty, Granny Smith, Tydeman's Early Worcester, Cortland, Winston



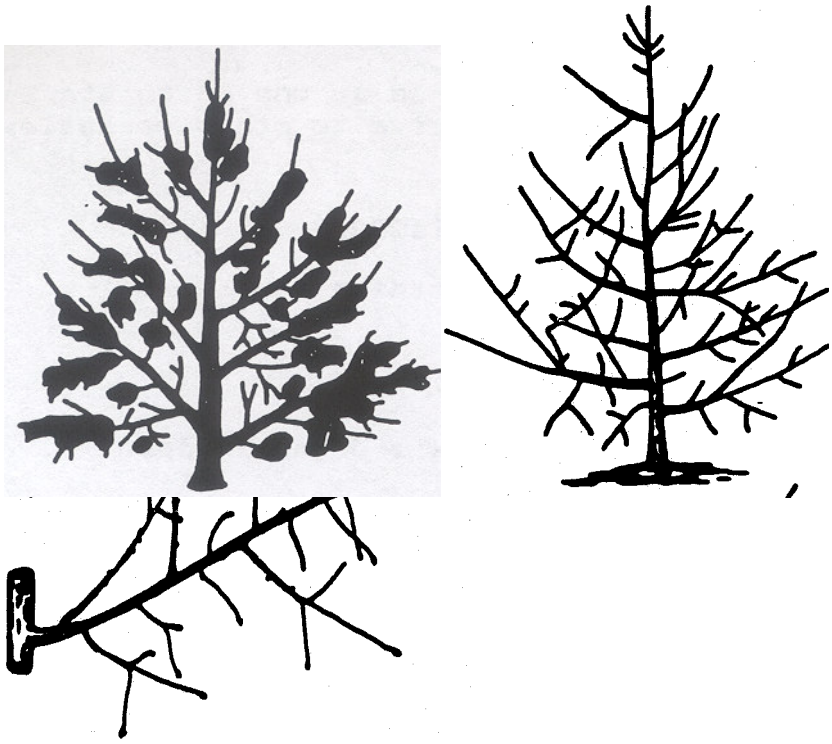
Type I, spur types, characterized by Starkrimson Delicious. Type I trees tend to be upright with narrow crotches and sparse branching.

Fruiting occurs on numerous short spurs, which are long lived. The zone of fruiting tends to remain close to trunk.

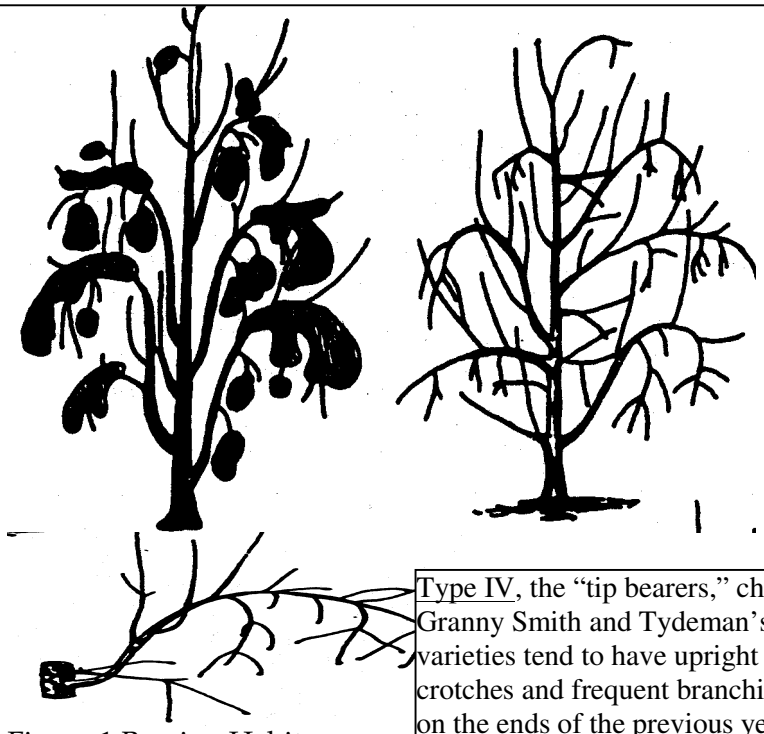


Type II, characterized by King of Pippins, This is a variation of type I in which branching is more frequent and there is a greater tendency for the fruiting zone to move away from the trunk

Figure 1. Bearing habit, based on the INRA system used by Lespinasse



Type III, characterized by ("standard") Golden Delicious. Type III varieties tend to be spreading with wide crotches and frequent branching. They bear on spurs and shoots which are generally 1 to 3 years of age. The fruiting zone tends to move away from the trunk to the outside of the tree.



Type IV, the "tip bearers," characterised by Rome Beauty, Granny Smith and Tydeman's Early Worcester. Type IV varieties tend to have upright main scaffold limbs with narrow crotches and frequent branching. They bear much of the crop on the ends of the previous year's shoots. There is a strong tendency for the lower half of the shoots to be without leaves or fruit, that is, "bare" or "blind." There is a strong tendency for the fruiting wood to be located at the extremities of the branches, with the tree spreading as a result.

Figure 1 Bearing Habits

6.2.7 Precocity of bearing

A precocious tree is defined as one of which starts to crop at an early age relative to other varieties on the same rootstock

		Reference
1	Extremely low precocity	Northern Spy
3	Low precocity	
5	Intermediate	Cox's Orange Pippin
7	High precocity	Golden Delicious
9	Extremely high precocity	'Malling' Greensleeves

6.2.8 Cropping efficiency (Productivity)

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

		Reference
1	Extremely low	
3	Low	Discovery
5	Intermediate	Cox's Orange Pippin
7	High	Golden Delicious
9	Extremely high	'Malling' Greensleeves

6.2.9 Fruit size

Average breadth after commercial grading of all fruits. Information on the uniformity of size can be recorded in the NOTES descriptor, 11

		Reference
1	Extremely small	Most Malus species
2	Very small	Api
3	Small	Pigeon, Beauty of Bath
4	Small / medium	Discovery, Cox's Orange Pippin
5	Medium	Golden Delicious
6	Medium large	Holsteiner Cox, Lobo
7	Large	Belle de Boskoop
8	Very large	Bramley's Seedling, Mutsu(Crispin)
9	Extremely large	Howgate Wonder

6.2.10 Fruit shape

Reference varieties will vary between sites and sometimes between years. See Figure 2.

1.0 Globose

1.1 Globose-conical

1.2 Short-globose-conical

2.0 Flat

2.1 Flat-globose (oblate)

3.0 Conical

3.2 Intermediate – conical

4.0 Ellipsoid

4.1 Ellipsoid-conical (ovate)

5.0 Oblong

5.1 Oblong-conical

5.2 Oblong – waisted

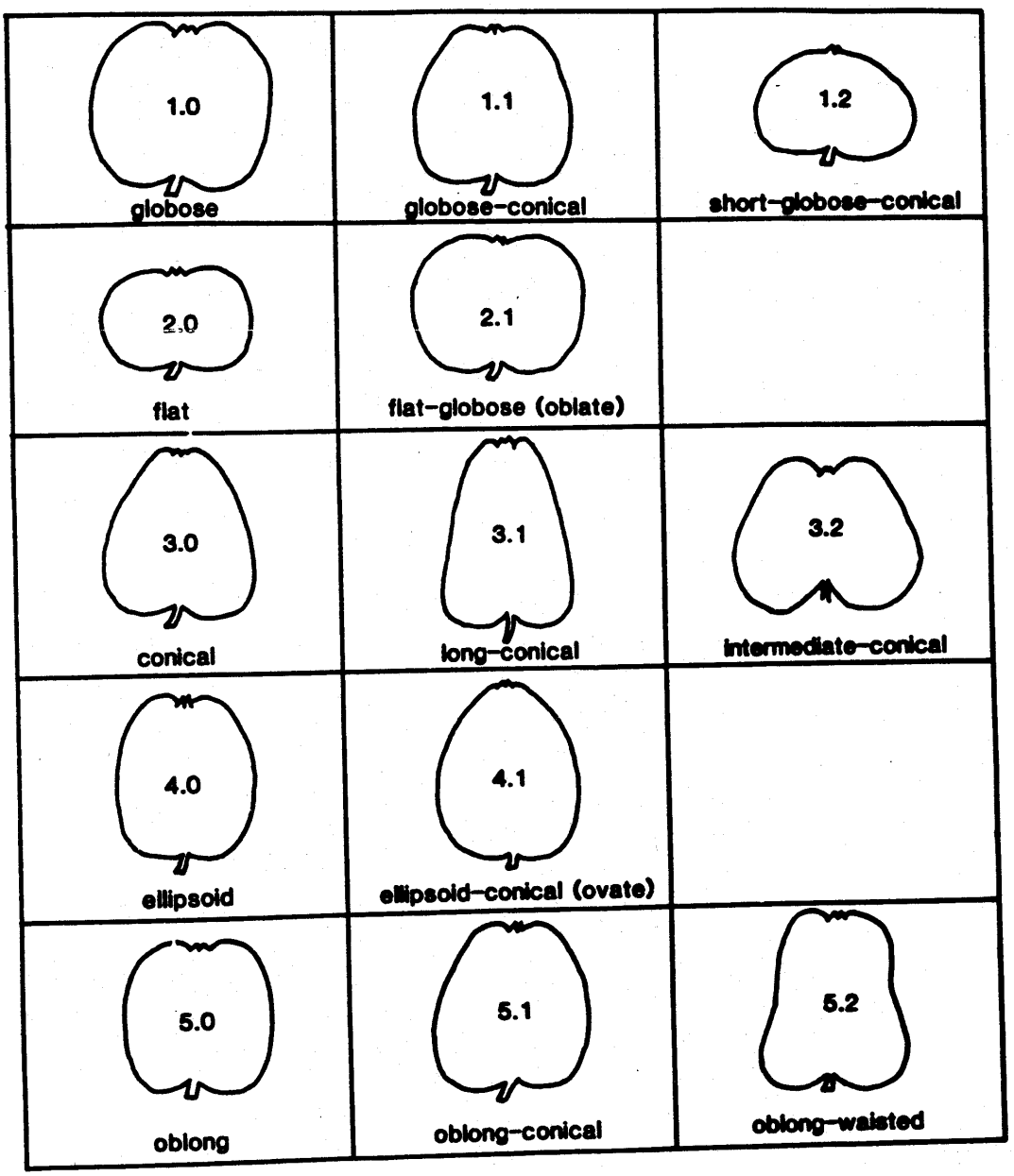


Figure 2. Fruit shape

6.2.11 Fruit Attractiveness

This is a subjective factor, varying between regions and between experts

		Reference
1	Extremely poor	Egremont Russet
3	Poor	Cox's Orange Pippin
5	Intermediate	Spartan, Golden Delicious
7	Good	Gloster 69
9	Extremely good	Discovery

6.2.12 Ground colour

Ground colour of the skin of fully mature fruit

		Reference
1	Red	Baskatong
2	Orange	
3	Cream-white	
4	Yellow	Golden Delicious
5	Green-yellow	Cox's Orange Pippin
6	Green	Granny Smith

6.2.13 Over colour

Over colour of the skin of fully mature fruit. Additional information can be recorded in the NOTES descriptor, 11

		Reference
1	Orange	Egremont Russet, Alice
2	Pink	Khoroshavka Alaya
3	Red	Jonathan
4	Dark red	Court Pendu Noir, Starking
5	Purple	Spartan
6	Brown	Lord Burghley

6.2.14 Type of over colour

		Reference
1	Striped	
2	Streaked	
3	Mottled	
4	Splashed	
5	Slightly blushed	
6	Washed-out (faded)	
7	Complete over colour	
8	Other, specify in NOTES descriptor, 11	

6.2.15 Russet amount

Amount of russet expressed as the usual percentage of fruit surface russetted. Record high season-to-season variability in the NOTES descriptor, 11

		Reference
1	0%	Lobo
2	12%	Golden Delicious
3	25%	Cox's Orange Pippin
4	37%	
5	50%	Belle de Boskoop
6	62%	
7	75%	Egremont Russet
8	87%	Zabergau Reinette
9	100%	Siddington Russet

6.2.16 Russet type

		Reference
1	Extremely fine	Landsberger Reinette
2	Very fine	Golden Delicious
4	Intermediate	Cox's Orange Pippin
6	Coarse	Zabergau Reinette
8	Scaly	Paroquet
9	Cracked	

6.2.17 Harvest Maturity (Season of maturity for picking)

A repeat of 4.2.1 but at a further evaluation site

		Reference
1	Extremely early	Close, White Transparent, Jerseymac
2	Very early	Discovery
3	Early	Tydeman's Early Worcester, Paulared
4	Early/mid-season	James Grieve
5	Mid-season	Cox's Orange Pippin
6	Mid-season/late	Delicious, Golden Delicious
7	Late	Northern Spy, Blaxtayman, Jonagold
8	Very late	Glockenapfel
9	Extremely late	Rome Beauty, Granny Smith

6.2.18 Maximum storage life

A repeat of 4.2.2. but at a further evaluation site

6.2.17.1 Maximum number of days stores satisfactorily under the conditions specified in 6.2.17.2 to 6.2.17.6

6.2.17.2 Air storage

0 = No

\+ = Yes

6.2.17.3 Temperature ^{o}C

6.2.17.4 Parentage oxygen

6.2.17.5 Percentage carbon dioxide

6.2.17.6 Percentage humidity

6.2.19 *Eating maturity

Time fruit ripe for eating following storage in air at optimum commercial temperature and ripened for one week at 10 degrees centigrade

		Reference
1	Extremely early	
3	Early	Beauty of Bath, Tydeman's Early Worcester
5	Mid-season	Cox's Orange Pippin, Egremont Russet Charles Ross
7	Late	Belle de Boskoop
9	Extremely late	Glockenapfel

6.2.20 Eating quality (dessert)

A combined assessment of flavour, acidity, sweetness, aroma and astringency at optimum eating time, if necessary following storage in air at best commercial storage temperature

		Reference
1	Extremely poor	Bramley's Seedling
2	Very poor	
3	Poor	Granny Smith
4	Poor/intermediate	Gloster 69
5	Intermediate	Red Delicious
6	Intermediate/good	Golden Delicious
7	Good	McIntosh
8	Very good	Cox's Orange Pippin
9	Extremely good	Belchard

6.2.21 Eating quality (cooked)

A combined assessment of quality (see 6.2.20)

		Reference
3	Poor	
5	Intermediate	
7	Good	Bramley 's seedling

6.2.22 Bitter pit susceptibility

Amount of bitter pit in the field

		Reference
0	None	
1	Extremely slight	
2	Very slight	Spartan
3	Slight	Golden Delicious
4	Slight/intermediate	
5	Intermediate	Reine des Reinettes
6	Intermediate / severe	Cox's Orange Pippin
7	Severe	Egremont Russet
8	Very severe	
9	Extremely severe	Merton Worcester

6.2.23 Bruising susceptibility

Susceptibility to bruising (fully mature fruit), condition of sample in storage tray

		Reference
1	Extremely slight	
2	Very slight	'Malling' Suntan, Spartan
3	Slight	Pomme de Fer, Cox's Orange Pippin
4	Slight/intermediate	Mutsu (Crispin)
5	Intermediate	Golden Delicious
6	Intermediate/high	
7	High	James Grieve
8	Very high	
9	Extremely high	Melba, Mantet, McIntosh

6.2.24 Firmness without skin

Recorded in kg, on fruit which is just ripe, and on a part of the fruit from which the outer skin has been removed and using an 'Effegie' or equivalent penetrometer with an 8 mm probe. See technical note on page 8, last paragraph

Kg pressure	Firmness	Reference
1.0	Extremely soft	
1.5	Very soft	Lobo
2.0	Soft	McIntosh
2.5	Soft/intermediate	
3.0	Intermediate	Cox's Orange Pippin
3.5	Intermediate/firm	Golden Delicious
4.0	Firm	
4.5	Very firm	Granny Smith
5.0	Extremely firm	

6.2.25 Texture

The texture of the flesh of the fruit when ripe

		Reference
1	Extremely coarse	
3	Coarse	
5	Intermediate	
7	Fine	
9	Extremely fine	

7. STREES SUSCETIBILITY

Based on the 1-9 scale, where

1 Extremely low susceptibility
3 Low susceptibility
5 Medium susceptibility
7 High susceptibility
9 Extremely high susceptibility

7.1 LOW TEMPERATURE

Additional information concerning type of susceptibility can be recorded in the NOTES descriptor 11, i.e. minimum temperature without damage, differences in bud and wood susceptibility etc.

7.1.1 Low temperature - late autumn/early winter

		Reference
1	Extremely hardy	
3	Hardy	
5	Intermediate	
7	Tender	
9	Extremely tender	

7.1.2 Low temperature - mid-winter

		Reference
1	Extremely hardy	M.robusta 5, Heyer 12
3	Hardy	Antonovka clones, Hibernal
5	Intermediate	McIntosh
7	Tender	Delicious
9	Extremely tender	

7.1.3 Low temperature- spring

Especially at critical stages in relation to flowering

		Reference
1	Extremely hardy	K14, K18
3	Hardy	M.26
5	Intermediate	
7	Tender	M. robusta 5
9	Extremely tender	

7.2 HIGH TEMPERATURE

7.3 DROUGHT

7.4 HIGH SOIL MOSITURE

7.5 CHLOROSIS

8. PEST AND DESEASE SUSCEPTIBILITY

Based on a 1-9 scale of general field susceptibility, where

3	Low susceptibility
5	Medium susceptibility
7	High susceptibility

If the race is known, record in NOTES descriptor, 11

8.1 PESTS

8.1.1	*Eriosoma lanigerum*	woolly aphid
8.1.2	*Cydia pomonella*	codling moth
8.1.3	*Dysaphis plantagea*	rosy apple aphid
8.1.4	etc.	

8.2 FUNGI

8.2.1	*Podosphera laucotricha*	mildew
8.2.2	*Venturia inaequalis*	scab
8.2.3	*Nectria galligena*	canker
8.2.4	*Phytophthora cactorum*	collar rot, root rot
8.2.5	etc.	

8.3 BACTERIA

8.3.1	*Erwinia amylovora*	fireblight
8.3.2	etc.	

8.4 VIRUS AND MYCOPLASMA

8.4.1	etc.

1/ The 1-9 scale corresponds to the Van der Zwet scale and the portion of the tree blighted as follows:

	Van der Zwet scale	Portion of tree blighted
1	10+9	0-3%
2	8	4-6%
3	7	7-12%
4	6	13-25%
5	5	26-50%
6	4	51-75%
7	3	76-88%
8	2	89-99%
9	1	100%

9. ALLOENZYME COMPOSITION

This may prove to be a useful tool for identifying duplicate accessions

10. CYTOLOGICAL CHARACTERS AND IDENTIFIED GENES

11. *NOTES

Give additional information where descriptor state is noted as 'Other' as might appear in descriptors (e.g. 2.10 and 4.1.1.8). Also include here any further relevant information (where necessary)

Appendix I

SUMMARY OF BASIC CEC APPLE DESCRIPTORS

PASSPORT

APPENDIX II

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