Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability

On

Guava
(*Psidium guajava* L.)

Protection of Plant Varieties and Farmers' Rights Authority

(PPV & FRA)

Government of India, New Delhi

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I. Subject

These test guidelines shall apply to all varieties, hybrids & parental lines of guava (*Psidium guajava* L.)

II. Materials required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) shall decide on the quantity and quality of the plant material required for testing the variety and when and where it is to be delivered for registration under the Protection of Plant Variety and Farmers' Rights Authority (PPV & FRA), 2001. Applicants submitting such plant material from a country other than India shall make sure that all customs and quarantine requirements stipulated under relevant national legislations and regulations are complied with.
2. The material is to be supplied in the form of 10 grafts/ air layers with well established root system for each location.
3. The plant material supplied should be visibly healthy, not lacking in vigour, nor affected by any pest or diseases.
4. The plant material should not have undergone any treatment, which would affect the expression of the characteristics of the variety, unless the PPV & FRA may allow or request such treatment. If it has been treated, full details of the treatment must be given.

III. Conduct of tests

1. The minimum duration of the DUS tests shall normally be at least two fruiting seasons in different years. Test should be conducted in at least two places.
2. The tests should be carried out under conditions ensuring satisfactory growth for the expression of the relevant characteristics of the variety and for the conduct of the examination. In particular, it is essential that the trees produce a satisfactory crop of fruit in each of the two growing cycles.
3. If a crop cycle is affected due to un-natural circumstances and if any essential characteristic of the candidate variety is not expressed for visual observations at these locations, the variety shall be considered for further examination at appropriate test site or under special test protocol on expressed request of the applicant, for which additional quantity of planting materials shall be required.
4. The field tests shall be carried out under open field conditions favouring normal growth and expression of all the test characteristics.

5. **Test Plot Design**

The design of the tests should be such that plants or parts of plants may be removed for measurement or counting without prejudice to the observations which must be made up to the end of the growing cycle.
Unless otherwise indicated, all observations should be made on 6 plants or parts taken from each of 6 plants.

The additional test protocol for special purpose may be established by PPV & FRA.

1. Locations: DUS testing centres (ICAR-CISH, Lucknow & ICAR-IIHR, Bengaluru)
2. No. of replications: 6
3. Spacing: 3 X 3 m
4. Treatment unit: 6 X 3=18 sq m

On-site DUS testing

- The applicant or his/her nominee on his/her behalf shall submit a request to the Authority for conducting a reliable trial according to Test Guidelines and the instructions from Authority before on-site examination of the candidate variety.
- The applicant or his/her nominee shall submit a request to the Authority for on-site examination prior to start of growing cycle as mentioned in Test Guidelines for site examination of the candidate variety.
- On-site testing may be conducted at the places specified by the applicant. The age of the trees at on-site shall be minimum 3 years.
- As a minimum six trees planted in uniform spacing, should be available for inspection and examination for 'on site' DUS testing. The trees must be healthy and free from pest & disease and raised under standard management practices. For farmer's variety or landraces, the authority may notify suitable guidelines on the number of plant(s) and season(s), if any.
- On-site examination shall be arranged during the fruiting season, when distinguishing characteristics of candidate variety can most easily be seen. The characteristics of the candidate variety can be examined and compared with those of the comparative varieties as per the Test guidelines.
- The Expert Committee constituted by the PPV & FRA in consultation with the DUS Centre shall be authorized to inspect on-site testing and recording of the appropriate characters. Applicant shall supply the Expert Committee with summary of distinct characteristics supported by photographs.
- The Expert Committee shall take notes and observations on distinctness and shall confirm preliminary data and/or summary of distinctness from applicant.
- The Expert Committee shall submit examination report to the Authority.

IV. Methods and observations

The differences observed between varieties may be so clear that more than one growing cycle is not necessary. In addition, in some circumstances, the influence of the environment is not such that more than a single growing cycle is required to provide assurance that the differences observed between varieties are sufficiently consistent.

Determining whether a difference between two varieties is clear depends on many factors, and should consider, in particular, the type of expression of the characteristic being examined, *i.e.* whether it is expressed in a qualitative, quantitative, or pseudo-qualitative manner.

- All observations on the young leaf should be made during a period of active growth (flush), on leaves 3-5 cm in length.The attitude of branches are to be recorded in the unpruned trees of minimum of three years of age.
- Young leaf: Anthocyanin coloration should not be recorded during winter where anthocyanin development on leaves prevalent during winter.
- All observations on the fully developed shoot and fully developed leaf should be made in the middle third of the current season's growth, after the period of active growth.
- All observations on flower should be made during peak flowering.
- The fruits are to be harvested at mature colour break stage (edible ripeness) that are ready for consumption.
- All observations on the fruit shall be recorded at the edible ripeness stage from the fruits harvested at periodical intervals from each test plant.
- For the assessment of colour characteristics, Royal Horticultural Society (RHS) colour chart shall be used wherein the specific colour groups shall be mentioned with distinctiveness. For recording peel or skin colour, pulp colour and number of seeds/ 100 g fruit weight fully ripe fruits are to be considered.
- Thickness of the outer pulp (pericarp) in relation to the core diameter is to be recorded in the cross section of the fruit which should be made at the broadest part of the fruit.
- The fruit acidity is to be measured by standard titration method
- Fruit sweetness is to be measured by using refractrometer and expressed as ^{0}B
- Seed hardiness is measured as the pressure required to break the seed and expressed as kg/cm^2
- Number of seeds per 100g fruit weight is counted and expressed as seed number per 100g fruit

- The description should be supplemented by shadow graphs of leaves from the middle of the mature vegetative branch and imprints of longitudinal median section of fruits.

Sl.No.	Stage of observation	Decimal Coding
1	At vegetative	10
2	At flowering	20
3	At fruit maturity	30
4	At edible stage of ripe fruit after harvest	40

V. Grouping of varieties

1. The candidate varieties for DUS testing shall be divided into groups to facilitate the assessment of Distinctiveness. Characteristics, which are known from experience not to vary, or to vary only slightly within a variety and which in their various states are fairly evenly distributed across all varieties in the collection are suitable for grouping purpose.
2. Grouping characteristics are those in which the documented states of expression, even where produced at different locations, can be used, either individually or in combination with other such characteristics: (a) to select varieties of common knowledge that can be excluded from the growing trial used for examination of distinctiveness; and (b) to organize the growing trial so that similar varieties are grouped together.

The following characteristics are to be used for grouping guava varieties:

(i) Fruit: shape at stalk end (characteristic 19)

(ii) Fruit: Prominence of neck (characteristic 20)

(iii) Fruit: colour of peel (characteristic 21)

(iv) Fruit: relief of surface (characteristic 22)

(v) Fruit: colour of pulp (characteristic 28)

VI. Characteristics and symbols

1. To assess Distinctness, Uniformity and Stability, the characteristics and their states as given in the Table of characteristics (Section VII) shall be used.
2. Notes (1 to 9) shall be given for each state of expression for different characteristics for the purpose of electronic data processing.

3. Legend

(*) Characteristics that shall be observed during every growing season on all varieties and shall always be included in the description of the variety, except when the state of expression of any of these characters is rendered impossible by a preceding phenological characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.

(+) See Explanation on the Table of characteristics in Section VIII. It is to be noted that for certain characteristics *viz.,*

4. The plant parts on which observations to be taken are given in the explanation or figure(s) for clarity and not the colour variation.

5. Characteristics denoted with symbols **QL, QN** and **PQ** in the first column of the Table of characteristics shall be indicated as;

- **QL:** Qualitative characteristic
- **QN:** Quantitative characteristic
- **PQ:** Pseudo-qualitative characteristic

6. Type of assessment of characteristics indicated in column 7 of table of characteristics is as follows;

MG: Measurement by a single observation of a group of plants or parts of plants

MS: Measurement of a number of individual plants or parts of plants

VG: Visual assessment by a single observation of a group of plants or parts of plants

VS: Visual assessment by observations of individual plants or parts of plants

VII Table of characteristics

Sl. No.	Characteristics	States	Notes	Example variety	Stage of Observation	Type of Assessment MG/MS/ VG/VS
1	**2**	**3**	**4**	**5**	**6**	**7**
(*) 1 QL	Tree: attitude of branches	Erect Spreading Drooping	3 5 7	Hong Kong White, Nagpur seedless Sardar, Sindh, Arka Mridula Superior Sour Lucidium	10	VG
(*) 2 PQ	Young shoot: colour of stem	Green Green with red streaks Dark red	3 5 7	Dharwar, Nasik, Nagpur seedless Florida Seedling, Shweta, Lalit Purple guava	10	VG
3 PQ	Young leaf: anthocyanin coloration	Absent Present	1 9	EC-147037 Webber Supreme, Lalit	10	VG
4 QN	Fully developed leaf: length of blade (cm)	Short (< 10.0 cm) Long (> 10.0 cm)	3 7	Apple Color Lalit, Dhareedar	10	MS
5 QN	Fully developed leaf: width of blade (cm)	Narrow (< 4.0 cm) Broad (>4.0 cm)	3 7	Apple color Sardar, Nagpur seedless	10	MS
6 QN	Fully developed leaf: length/width ratio of blade (cm)	Narrow (<2.50cm) Broad (>2.50 cm)	3 7	Purple Guava, Apple color Dhareedar, Shweta	10	MS
7 (+) QL	Fully developed leaf: shape	Round Trullate Oblong	3 5 7	Nagpur seedless Ec-147036 Arka Mridula, Kohir Jam, Lalit,	10	VG
8 QL	Fully developed leaf: twisting	Absent Present	1 9	Allahabad Safeda, Nasik Spear acid, Banarasi	10	VG
9 QL	Fully developed leaf: variegation	Absent Present	1 9	Shweta, Allahabad Safeda Varigated Guava.	10	VG
10 PQ	Fully developed leaf: color	Green group Greyed red Purple	1 9	Allahabad Safeda, Arka Mridula, Lalit Purple guava	10	VG
11 QL	Fully developed leaf: pubescence on lower side	Sparse Dense	1 9	Red Flesh, Apple color Purple guava	10	VG
12 QL	Fully developed leaf: shape of base	Obtuse Rounded Cordate	1 2 3	Superior Sour Lucidium, Kamsari Lalit, Shweta, Nagpur seedless EC-147036, Chittidar	10	VG
13 (+)	Fully developed leaf: shape of tip	Acute Obtuse	3 5	Florida seedling, Apple color Lalit, Shweta, Purple guava	10	VG

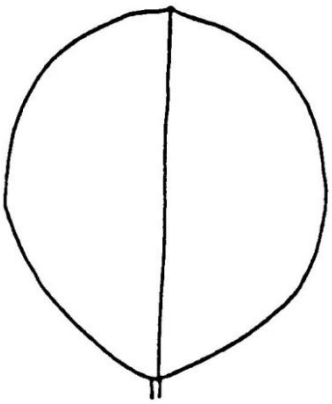
QL		Rounded	7	Nagpur seedless		
14 QN	Inflorescence: predominant number of flower	Upto two More than two	1 3	Guinees, Florida Seedling Spear acid, Shweta, HPSI-46	20	MS
15 (*) QN	Period from flowering to fruit maturity	Short (<120 days) Medium (121-140) Long (>140 days)	3 5 7	Hong Kong White, Apple color White flesh, Chittidar Jaraiya-2,Kamsari,Abu Ishakwala	30	VG
(*)16 QN	Fruit: length (cm)	Short (<4.0cm), Medium (4.1-6.0 cm) Long (>6.1 cm)	3 5 7	Red Flesh Arka Mridula, Allahabad safeda Lalit, HPSI-36, white flesh	40	MS
(*)17 QN	Fruit: width (cm)	Narrow (<4.0cm) Medium (4.1-6.0 cm) Broad (>6.1 cm)	3 5 7	Taiwan Smooth green, Arka Amulya Seedless, Shweta	40	MS
(*)18 QN	Fruit: ratio length/ width (cm)	Narrowl (<1.0 cm) Medium (1.0-1.2 cm) Broad (> 1.2 cm)	3 5 7	Purple guava Kamsari, Behat coconut White flesh, Allahabad safeda	40	MS
(*)19 QL (+)	Fruit: shape at stalk end	Broadlyrounded Rounded Truncate Pointed Necked	1 2 3 4 5	Chakaiya Rehman Nagar Allhabad Safeda, Chittidar Guinees Baraimpur, Harijha, EC-147039 Webber Supreme, White Flesh	40	VG
(*)20 QL (+)	Fruit: Prominence of neck	Absent Present	1 9	Allahabad safeda, Shweta HPSI-46, White flesh	40	VG
(*)21 PQ	Fruit: color of peel/ Pericarp	Yellow white group Greyed Yellow group Yellow Green group Red Blush Purple	1 2 3 4 5	White flesh, Nasik, Dharwar Spear acid, Red flesh Florida seedling Apple color Purple guava	40	VG
(*)22 QL	Fruit: relief of surface	Smooth Rough	1 2	Hong Kong White,Nasik, Smooth green Spear acid, Dhareedar	40	VG
23 QL	Fruit: longitudinal ridges	Absent Present Prominent	3 5 7	Arka Amulya, Shweta Anakapalli, white flesh Dhareedar	40	VG
24	Fruit: longitudinal	Absent	1	Hong Kong White, Anakapalli	40	VS

QL	grooves	Present	9	Apple color, Hybrid Supreme		
(*)25 (+) QN	Fruit: diameter of calyx cavity in relation to that of fruit (cm)	Small (<1.0 cm) Large (>1.0 cm)	3 5	Nasik, Allahabad safeda, Shweta, Arka Mridula Guinees, Pant Prabhat, Kamsari	40	MS
26 (+) QL	Fruit: ridged collar around calyx cavity	Inconspicuous Conspicuous	1 9	Nasik, Mankapur Type, Apple color Sardar, Chittidar, Nagpur seedless	40	VG
27 QN	Fruit: length of stalk (cm)	Short (<1.5 cm) Long (>1.5 cm)	3 5	Arka Mridula, Kohir Jam, Allahabad Safeda Webber Supreme, Dhareedar	40	MS
(*)28 QL	Fruit: color of pulp	White group Yellow white group Greyed orange group Red Group Red Purple Group	1 2 3 4 5	Nasik, Dharwar, Dhareedar Mankapur Type, Arka Amulya R-2-30, Spear acid EC-147037, Lalit Purple Guava	40	VG
(*)29 (+) QN	Fruit: thickness of outer pulp in relation to core diameter (cm)	Thin (<1.0 cm) Medium (1.1 – 1.5 cm) Thick (>1.5 cm)	3 5 7	EC-147039, Purple guava Allahabad safeda, Arka Mridula Shweta, Nagpur seedless, sardar	40	MS
(*)30 QL	Fruit: puffiness	Absent Present	1 9	Nasik, Lalit, Sardar Webber Supreme, Ec 147037l	40	VS
(*)31 QL	Fruit: acidity (%)	Low (<0.3-0.5%) Medium(<0.51-0.7%) High (<0.71-1.0%)	3 5 7	Arka Mridula, Shweta, Lalit Surkha Chitti Neputani Spear acid, EC-147036	40	MS
(*)32 QL	Fruit: sweetness (^{0}B)	Low (<8.0 ^{0}B) Medium(8.01-10.0 ^{0}B) High (> 10^{0}B)	3 5 7	EC-147039, Karela, Smooth green, Nasik Lalit, Shweta, Arka Mridula	40	MS
(*)33 QL	Fruit: Flavour	Mild Strong	1 9	Sardar, Shweta Kamsari, Mankapur type	40	VG
(*)34 QN	Fruit: number of seeds per 100g fruit weight	Few(<50) Medium (151-250) Many(>250)	3 5 7	Seedless, White flesh Alal Red, Baruf khan Webber Supreme, Red Flesh, Pear Shaped	40	MS
35 QL	Seed Hardiness (Kg/cm^2)	Soft (<8.0 Kg/cm^2) Medium(8.0-12 Kg/cm^2) Hard(<12.0	3 5 7	Purple guava Arka Mridula, Shweta Dharwad, Kamsari	40	MS

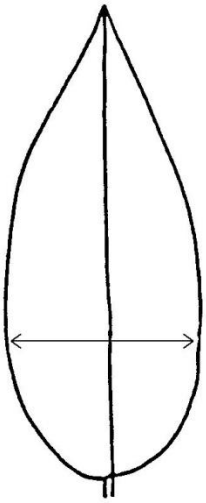
		Kg/cm^2)				

VIII. Explanations on the Table of Characteristics in sketch

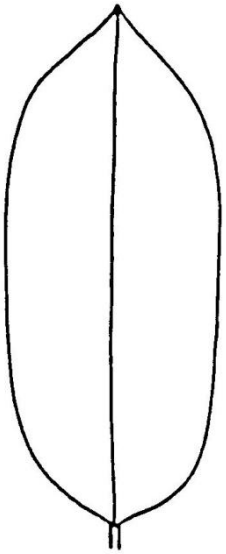
Characteristics 7. Fully developed leaf: shape



3. Round

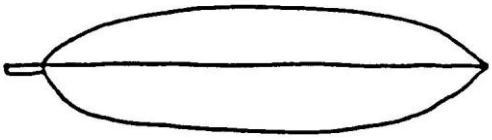


5. Trullate



7. Oblong

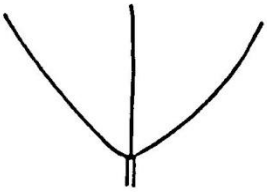
Characteristics 8. Fully developed leaf: twisting



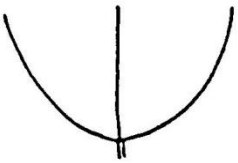
1 Absent

9. Present

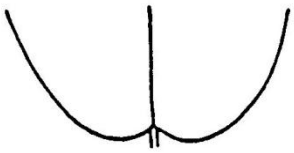
Characteristics 12. Fully developed leaf: shape of base



1. Obtuse



2. Rounded



3. Cordate

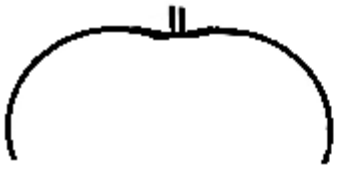
Characteristics 13. Fully developed leaf: shape of tip

3. Acute

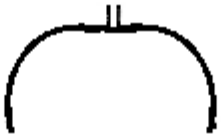
5 Obtuse

7. Rounded

Characteristics 19. Fruit: shape at stalk end



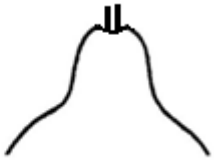
1. Broadly rounded



2. Rounded

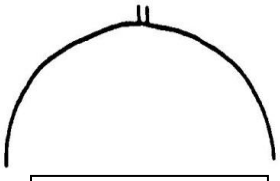
3 Truncate

4. Pointed

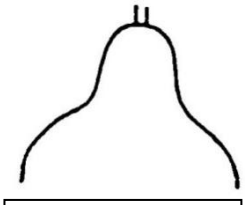


5. Necked

Characteristics 20. Fruit: Prominence of neck

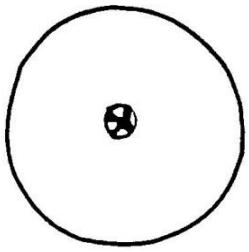


1. Absent

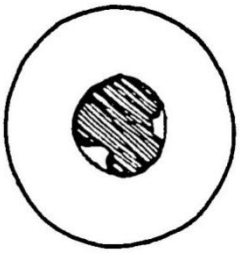


9. Present

Characteristics 25. Fruit: diameter of calyx cavity in relation to that of fruit

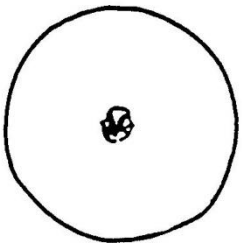


3. Small

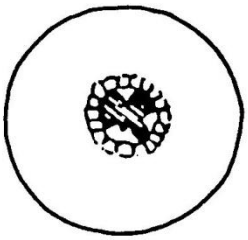


5. Large

Characteristics 23. Fruit: ridged collar around calyx cavity

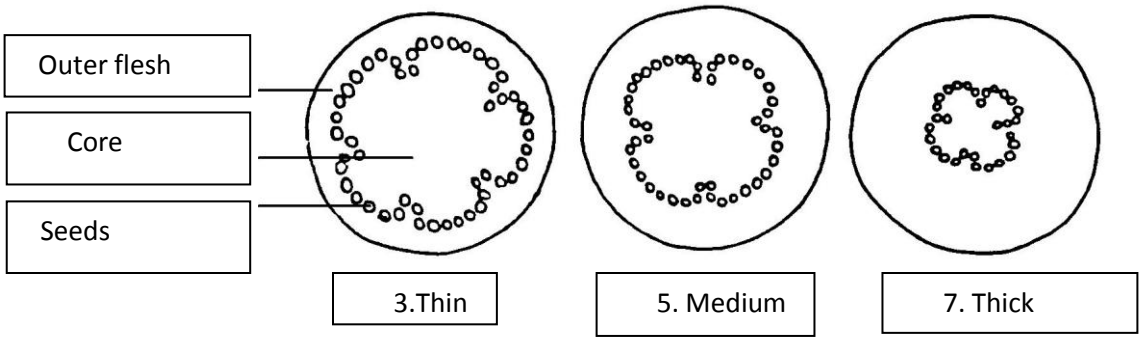


1. Inconspicuous



9. Conspicuous

Characteristics 29. Fruit: thickness of outer pulp in relation to core diameter



VIII. Explanations on the Table of Characteristics in picture

Characteristics 1: Tree: attitude of branches

Errect

Spreading

Drooping

Characteristics 2: Young shoot: colour of stem

Green

Green with Red streak

Dark red

Characteristics 3: Young leaf: anthocyanin coloration

Absent

Present

Characteristics 7: Fully developed leaf: shape

Round

Trullate

Oblong

Characteristics 9: Fully developed leaf: variegation

Absent **Present**

Characteristics 10: Fully developed leaf: color

Green group

Greyed red purple

Characteristics 12: Fully developed leaf: shape of base

Obtuse

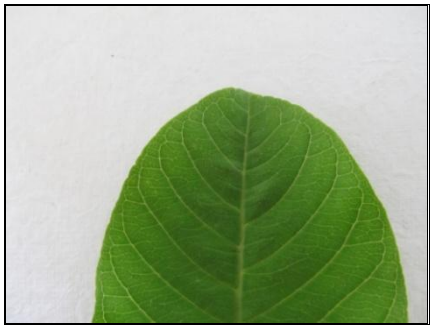
Rounded

Cordate

Characteristics 13: Fully developed leaf: shape of tip

Acute

Obtuse



Rounded

Characteristics 19: Fruit: shape at stalk end

Broadly Rounded

Rounded

Truncated

Pointed

Necked

Characteristics 20: Fruit: Prominence of neck

Absent

Present

Characteristics 21: Fruit: color of peel/ Pericarp

Yellow white group

Greyed Yellow group

yellow Green group

Yellow group with red blush

Red Purple group

Characteristics 22: Fruit: relief of surface

Smooth

Rough

Characteristics 23: Fruit: longitudinal ridges

Absent

Present

Prominent

Characteristics 24: Fruit: longitudinal grooves

Absent

Present

Characteristics 25: Fruit: diameter of calyx cavity in relation to that of fruit (cm)

Small

Large

Characteristics 26: Fruit: ridged collar around calyx cavity

Inconspicuous

Conspicuous

Characteristics 28: Fruit: color of pulp

White group

Yellow white group

Greyed Orange group

Red group

Red Purple Group

Characteristics 29: Fruit: thickness of outer pulp in relation to core diameter (cm)

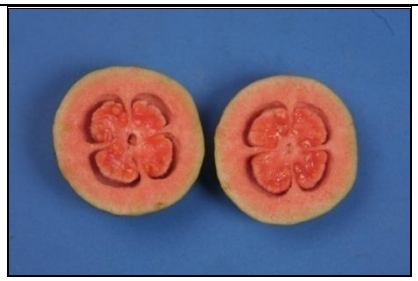
Thin

Medium

Thick

Characteristics 30: Fruit: puffiness

Absent



Present

Working Group details:

The task force has finalized the DUS test guidelines for **Guava** with support from all the members and nodal officer of the project for technical input.

The Members of the Task Force (21/11/2014), held on 27/1/2016 held at ICAR-CISH, Lucknow

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10 **Dr. Ravi Prakash** **Member Secretary**
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