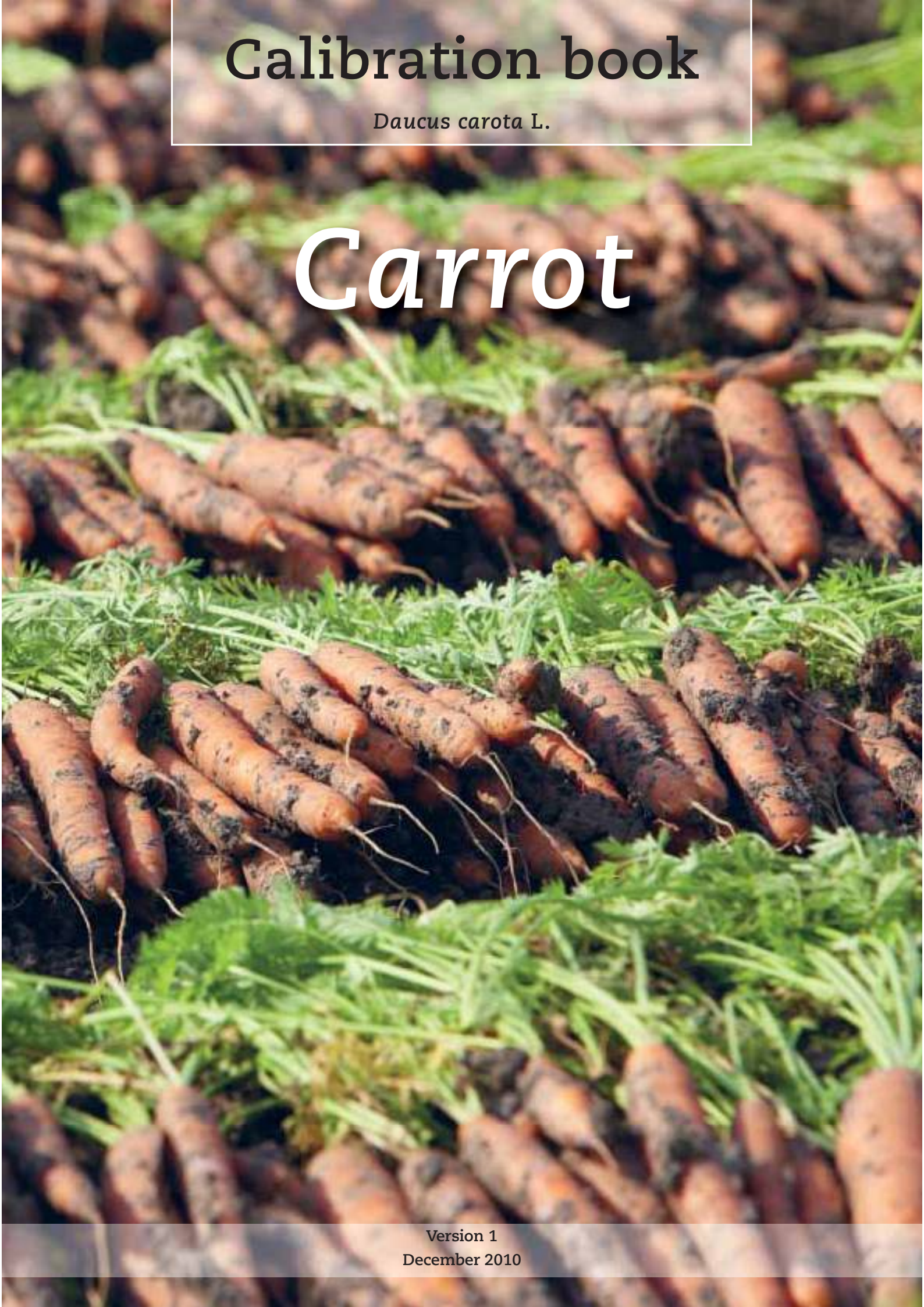
# Calibration book

*Daucus carota* L.



# *Carrot*

Version 1
December 2010

# Naktuinbouw calibration book

*Daucus carota* L.

# carrot

Version 1

## Introduction

In front of you, you find the Naktuinbouw calibration book carrot. This book may be used as guidance for the completion of application forms, the describing of varieties or the understanding of variety descriptions. This book can not replace the skill needed to make a variety description, but may serve as support.

**Sources used**
The basis for this book is the CPVO protocol CPVO-TP/049/3 which in its turn is based on UPOV Guideline TG/49/8. Please also use these sources for reference when using this calibration book. The application of this calibration book is based on the general UPOV principles on the definitions and use of characteristics of variety descriptions (UPOV TG/1/3)

**Application methodology**
The UPOV system is based on the expression of characteristics that are related to the expression values of example varieties. In the calibration book you find two types of characteristics; visually assessed characteristics and measured characteristics.
The value of the visually assessed characteristics can be compared with the visual value of the expression of example varieties. In the calibration book you may find drawings or pictures to assist in the decision on the applicable expression. For measured characteristics this is more complicated as in many cases the value of the measurements is depending on the (climatical) conditions of the trials. The use of example varieties in these cases is indispensable. The same applies for those visually assessed characteristics that are prone to influence by climate (e.g. anthocyanin coloration). In this calibration book these example varieties are only included for the characteristics that appear in the Technical Questionnaire. Others are not included as many prefer their own set of example varieties, but may be found in the relevant CPVO protocol.

**Website**
The CPVO and UPOV documents mentioned above can be found on the Naktuinbouw website (*http://www.naktuinbouw.nl/onderwerp/kalibratieboeken*). On this website you can also find announcements of possible modifications of the published calibration books.

**Helpdesk**
For possible remarks, suggestions and questions on the calibration books and the website, you may contact Naktuinbouw at our email address: kalibratieboek@naktuinbouw.nl

## Contents

## 1 Foliage: width of crown

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

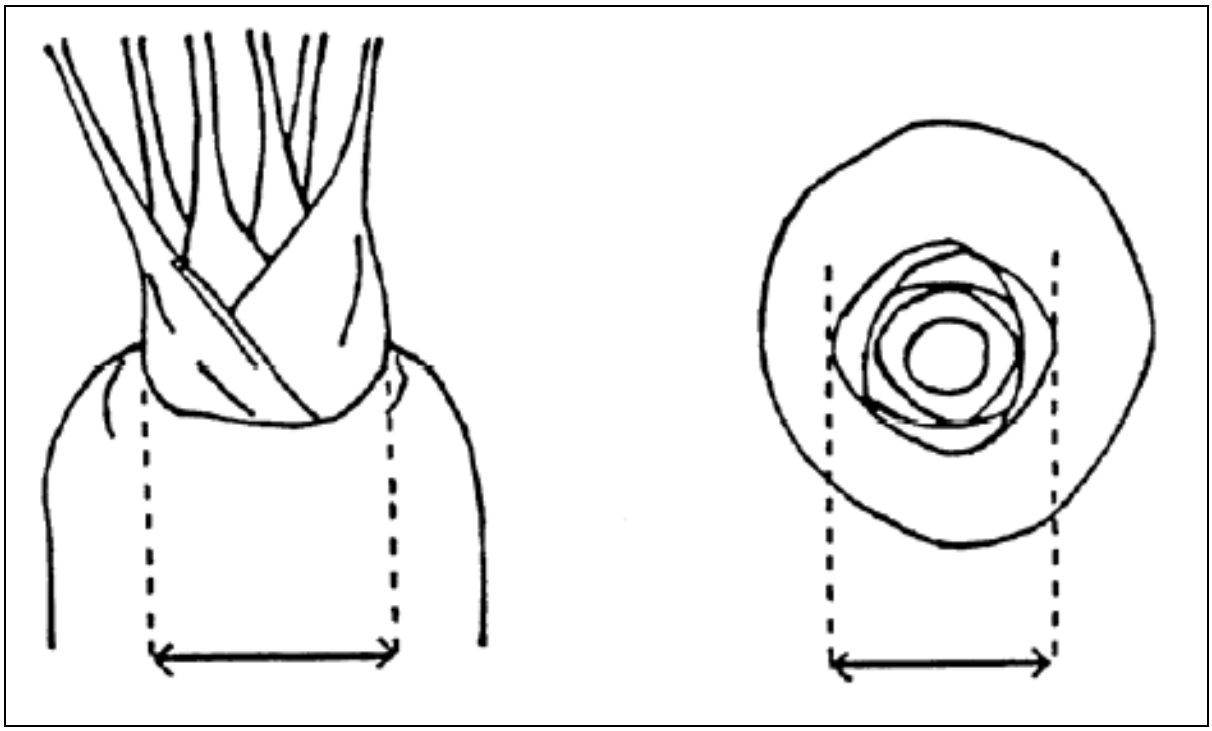
**Stage of observation:** In plants with a fully developed crown approximately three months after sowing.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: very narrow | |
| 2: very narrow to narrow | |
| 3: narrow | Amsterdam 2 |
| 4: narrow to medium | |
| 5: medium | Nantaise améliorée 2 |
| 6: medium to broad | |
| 7: broad | Chantenay à coeur rouge 2 |
| 8: broad to very broad | |
| 9: very broad | |

**CPVO explanation:**



Different points of orientation to observe the width of the crown.

## 1 Foliage: width of crown

| 3: narrow | 5: medium | 7: broad |
|---|---|---|
| (Amsterdam 2) | (Nantaise améliorée) | (Chantenay à coeur rouge 2) |

## 2 Leaf: attitude

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** In plants with a fully developed crown approximately three months after sowing.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**
1: erect
3: semi-erect
5: prostrate

## 3 Leaf: length (including petiole)

**Grouping characteristic:** yes.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation: MS/VG** – Choice between
**-** Calculated average of the measurement of 40 plants or parts of plants and
- Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** In plants with a fully developed crown approximately three months after sowing.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: very short | Mokum, Mignon |
| 2: very short to short | |
| 3: short | Amsterdam 2, Amsterdam 3 |
| 4: short to medium | |
| 5: medium | Nantes 2, Juwarot |
| 6: medium to long | |
| 7: long | Chantenay 2 |
| 8: long to very long | |
| 9: very long | Flakkese 2, Rothild |

## 3 Leaf: length (including petiole)

1:very short Mokum

3: short Amsterdam 2

5: medium Nantes 2

7: long Chantenay

## 4 Leaf: division

**Stage of observation:** In plants with a fully developed crown approximately three months after sowing.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**
1: very fine
2: very fine to fine
3: fine
4: fine to medium
5: medium
6: medium to coarse
7: coarse
8: coarse to very coarse
9: very coarse

## 4 Leaf: division

3: fine 5: medium 7: coarse

3: fine 5: medium 7: coarse

## 5 Leaf: intensity of green colour

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** In plants with a fully developed crown approximately three months after sowing.

**Method of observation:** Visual observation. Calibrate using example varieties. This character should be observed during clouded weather as direct sunlight makes it nearly impossible to perform a proper observation.

**Notes and states of expression:**

| | |
|---|---|
| 1: very light | |
| 2: very light to light | |
| 3: light | Adellaide, Leonor |
| 4: light to medium | |
| 5: medium | Amsterdam 2, Amsterdam 3 |
| 6: medium to dark | |
| 7: dark | Rothild |
| 8: dark to very dark | |
| 9: very dark | |

## 6 Leaf: anthocyanin coloration of petiole

**Grouping characteristic:** no.

**Type of characteristic**: **QL** – Qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** In plants with a fully developed crown approximately three months after sowing.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**
1: absent
9: present

1: absent 9: present

## 7 Root: length

**Grouping characteristic:** yes.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation: MS/VG** – Choice between
**-** Calculated average of the measurement of 40 plants or parts of plants and
- Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** During two phases: directly after harvesting (2-3 times) on the field after the final harvest.

**Method of observation:** First phase: Visual observation. Calibrate using example varieties. Second phase: image analyses of 40-50 fully developed carrots. The results of the second phase serve to support the visual observations.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: very short | Parijse markt 2, parijse markt 3 |
| 2: very short to short | |
| 3: short | Chantenay |
| 4: short to medium | |
| 5: medium | Nantes 2, Nantes 3 |
| 6: medium to long | |
| 7: long | Berlikumer 2, Berlikumer 3 |
| 8: long to very long | |
| 9: very long | Lange Stompe Winter, Topcut |

## 7 Root: length

| 3: short | 5: medium | 7: long | 9: very long |
|---|---|---|---|
| Chantenay | Nantes 3 | Berlikumer 3 | Topcut |

## 8 Root: width

**Grouping characteristic:** yes.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation: MS/VG** – Choice between
**-** Calculated average of the measurement of 40 plants or parts of plants and
- Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** During two phases: directly after harvesting (2-3 times) on the field after the final harvest.

**Method of observation:** First phase: Visual observation. Calibrate using example varieties. Second phase: image analyses of 40-50 fully developed carrots. The results of the second phase serve to support the visual observations.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: very narrow | |
| 2: very narrow to narrow | |
| 3: narrow | Amsterdam 2, Amsterdam 3, Tastypeel |
| 4: narrow to medium | |
| 5: medium | Nantes 2, Nantes 3 |
| 6: medium to broad | |
| 7: broad | De Colmar à coeur rouge 2, Parijse markt 2 |
| 8: broad to very broad | |
| 9: very broad | |

## 8 Root: width

| 3: narrow | 5: medium | 7: broad |
|---|---|---|
| Tastypeel | Nantes 3 | De Colmar à coeur rouge 2 |

## 9 Root: ratio length/ width

**Grouping characteristic:** no.

**Type of observation: MS/VG** – Choice between
**-** Calculated average of the measurement of 40 plants or parts of plants and
- Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** During two phases: directly after harvesting (2-3 times) on the field after the final harvest.

**Method of observation:** First phase: Visual observation. Calibrate using example varieties. Second phase: image analyses of 40-50 fully developed carrots. The results of the second phase serve to support the visual observations.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: very small | Parijse Markt 3 |
| 2: very small to small | |
| 3: small | Court améliorée à forcer |
| 4: small to medium | |
| 5: medium | De Colmar à coeur rouge 2 |
| 6: medium to large | |
| 7: large | Nantes 3 |
| 8: large to very large | |
| 9: very large | Tastypeel |

## 9 Root: ratio length/ width

| 5: medium | 7: large | 9: very large |
|---|---|---|
| De Colmar à coeur rouge 2 | Nantes 3 | Tastypeel |

## 10 Root: shape in longitudinal section

**Grouping characteristic:** yes.

**Type of characteristic**: **PQ** – Pseudo-qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** During two phases: directly after harvesting (2-3 times) on the field after the final harvest.

**Method of observation:** First phase: Visual observation. Calibrate using example varieties. Second phase: image analyses of 40-50 fully developed carrots. The results of the second phase serve to support the visual observations.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: circular | Parijse Markt 2 |
| 2: obovate | |
| 3: obtriangular (conical) | Chantenay |
| 4: narrow obtriangular | Imperator |
| 5: narrow obtriangular to narrow oblong | Maestro |
| 6: narrow oblong | Berlicumer 3 |

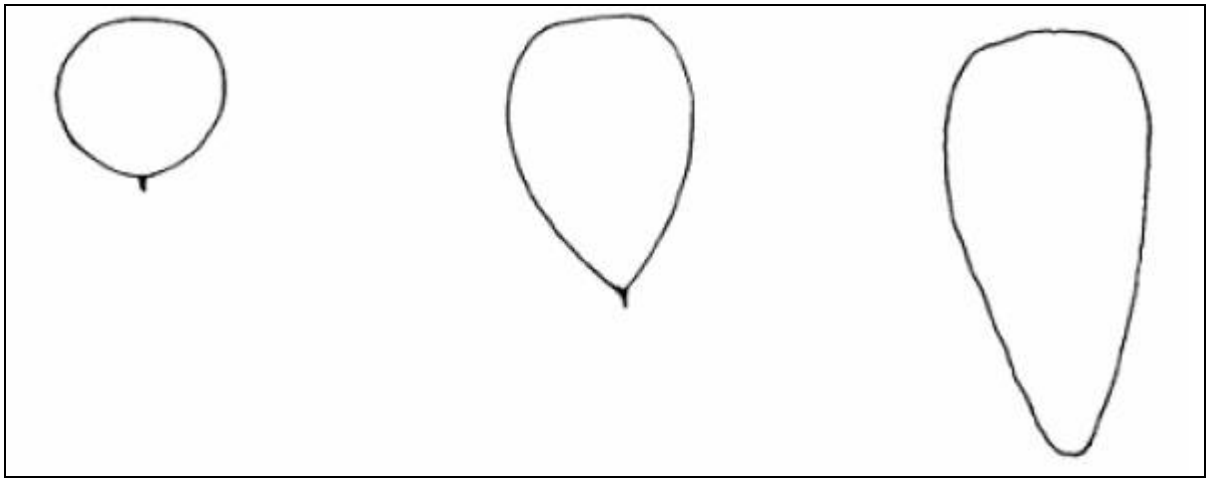
1: circular Parijse Markt

From left to right:

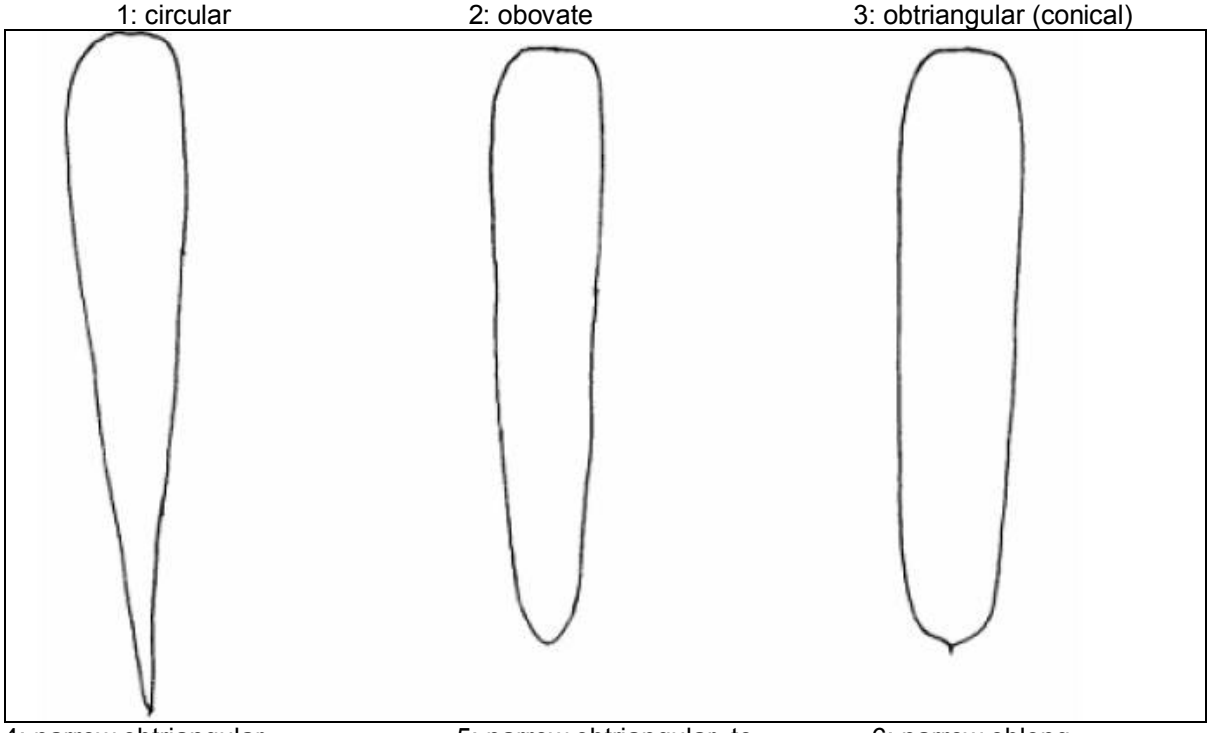
| | |
|---|---|
| 3: obtriangular (conical) | Chantenay |
| …….4: narrow obtriangular | Imperator |
| …….5: narrow obtriangular to narrow oblong | Maestro |
| …….6: narrow oblong | Berlicumer 3 |

## 10 Root: shape in longitudinal section

**CPVO explanation:**



1: circular 2: obovate 3: obtriangular (conical)



4: narrow obtriangular 5: narrow obtriangular to narrow oblong 6: narrow oblong (cylindrical)

## 11 <u>Varieties scoring between 4 and 6 for characteristic 10 only</u>: Root: tendency to conical shape

**Grouping characteristic:** no.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

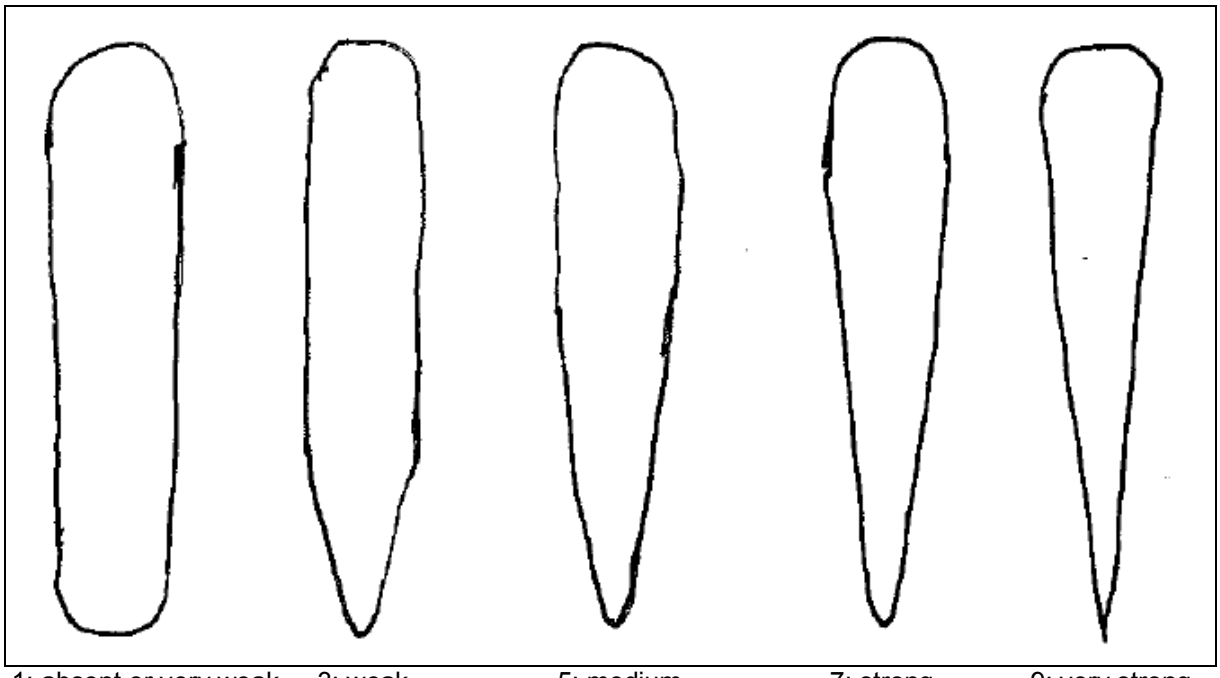
**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**
1: absent or very weak
2: very weak to weak
3: weak
4: weak to medium
5: medium
6: medium to strong
7: strong
8: strong to very strong
9: very strong

**CPVO explanation:**



1: absent or very weak 3: weak 5: medium 7: strong 9: very strong

## 12 Root: shape of shoulder

**Grouping characteristic:** no.

**Type of characteristic**: **PQ** – Pseudo-qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

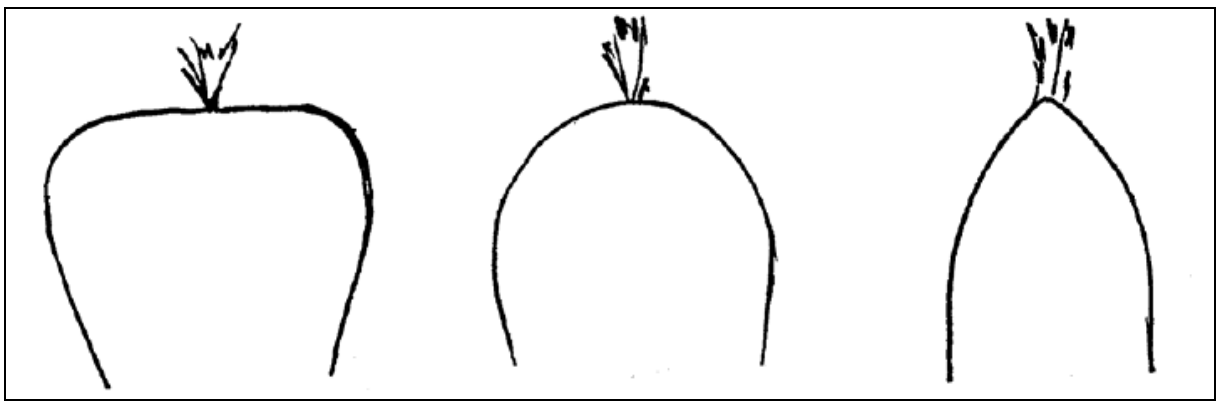
**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**

| | |
|---|---|
| 1: flat | De Colmar à Coeur rouge 2 |
| 2: flat to rounded | Parijse Markt 2 |
| 3: rounded | |
| 4: rounded to conical | |
| 5: conical | Touchon |

1: flat 2: flat to rounded 3: rounded 5: conical Touchon

**CPVO explanation:**



1: flat 3: rounded 5: conical

## 13 Root: tip (when fully developed)

**Grouping characteristic:** yes.

**Type of characteristic**: **PQ** – Pseudo-qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: blunt | Berlicumer 3 |
| 2: slightly pointed | Mello Yello |
| 3: strongly pointed | Deep Purple, Allred, Orbit |

1: blunt Berlicumer 3 | 2: slightly pointed Mello Yello | 3: strongly pointed Deep Purple

## 14 Root: External colour

**Grouping characteristic:** yes.

**Type of characteristic**: **PQ** – Pseudo-qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: white | White Satin |
| 2: yellow | Mello Yello |
| 3: orange | Berlicumer 3, Bingo, Tancar |
| 4: pinkish red | Nutri-red |
| 5: red | Pulsor |
| 6: purple | Deep Purple, Purple Haze |

1: white White Satin | 2: yellow Mellow Yellow | 3: orange Berlicumer 3 | 4: pinkish red Nutri-red | 6: purple Deep Purple

## 15 Excluding varieties with white external root colour: Root: intensity of external colour

**Grouping characteristic:** no.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**

| | |
|---|---|
| 1: very light | |
| 2: very light to light | |
| 3: light | Bingo, Mello Yello, Tancar |
| 4: light to medium | |
| 5: medium | Goliath, Nutri-red |
| 6: medium to dark | |
| 7: dark | Karotan, Pinocchio, Purple Haze |
| 8: dark to very dark | |
| 9: very dark | |

## 16 Root: anthocyanin coloration of skin of shoulder

**Grouping characteristic:** no.

**Type of characteristic**: **QL** – Qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity, but before harvesting.

**Note:** Many varieties turn red after reaching the stage of harvest maturity, and after having been harvested. This is also the case for varieties that do not show any red during the growing stage.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes, states of expression:**
1: absent
9: present

1: absent 9: present

## 17 Root: extent of green colour of skin of shoulder

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

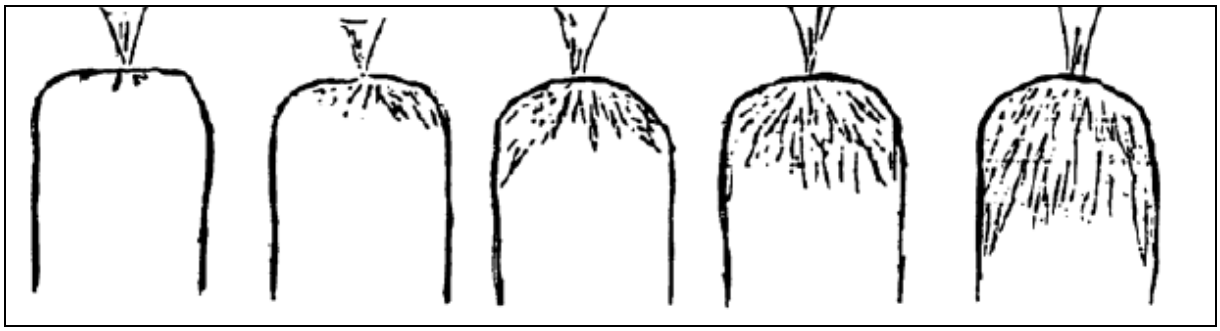
**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity, after harvesting.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**
1: absent or very small
2: very small to small
3: small
4: small to medium
5: medium
6: medium to large
7: large
8: large to very large
9: very large

**CPVO explanation:**



1: absent or very small 3: small 5: medium 6: large 7: very large

## 17 Root: extent of green colour of skin of shoulder

1: absent or very small 3: small 5: medium 7: large

## 18 Root: ridging of surface

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes, states of expression and example varieties:**
1: absent or very weak
2: very weak to weak
3: weak
4: weak to medium
5: medium
6: medium to strong
7: strong
8: strong to very strong
9: very strong

## 18 Root: ridging of surface

1: absent or very weak 3: weak 5: medium

## 19 Root: diameter of core relative to total diameter

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

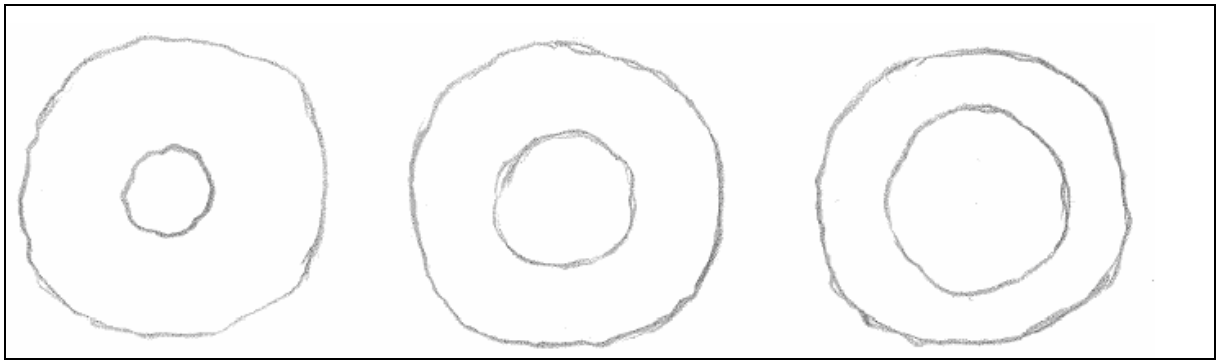
**Method of observation:** Visual observation. Calibrate using example varieties. Prepare a transverse section of the carrots.

**Notes, states of expression and example varieties:**

| | |
|---|---|
| 1: very small | Imperator, Amsterdam 2 |
| 2: very small to small | |
| 3: small | Nantes 3 |
| 4: small to medium | |
| 5: medium | Berlicumer 3 |
| 6: medium to large | |
| 7: large | De Colmar à coeur rouge 2 |
| 8: large to very large | |
| 9: very large | Giganta |

| 1: very small | 3: small | 5: medium | 7: large |
|---|---|---|---|
| Imperator | Nantes 3 | Berlicumer 3 | De Colmar à coeur rouge 2 |

**CPVO explanation:**



| 3: small | 5: medium | large |
|---|---|---|

## 20 Root: colour of core

**Grouping characteristic:** no.

**Type of characteristic**: **PQ** – Pseudo-qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation of a longitudinal section. Calibrate using example varieties.

**Notes and states of expression:**

| | |
|---|---|
| 1: white | White Satin |
| 2: yellow | Jaune de Lobberich, Pariser Markt |
| 3: orange | Nantes 2, Nantes 3 |
| 4: pinkish red | |
| 5: red | Nutri-red |
| 6: purple | Afghan purple, Black Deshi |

## 20 Root: colour of core

1: white 2: yellow 3: orange 4: pinkish red 6: purple

## 21 Excluding varieties with white core: Root: intensity of colour of core

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation of a longitudinal section. Calibrate using example varieties.

**Notes and states of expression:**
1: very light
2: very light to light
3: light
4: light to medium
5: medium
6: medium to dark
7: dark
8: dark to very dark
9: very dark

## 22 Root: colour of cortex

**Grouping characteristic:** no.

**Type of characteristic**: **PQ** – Pseudo-qualitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation of a longitudinal section. Calibrate using example varieties.

**Notes and states of expression:**
1: white
2: yellow
3: orange
4: pinkish red
5: red
6: purple

1: white 2: yellow 3: orange 4: pinkish red 6: purple

## 23 Excluding varieties with white cortex: Root: intensity of colour of cortex

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation of longitudinal section. Calibrate using example varieties.

**Notes and states of expression:**
1: very light
2: very light to light
3: light
4: light to medium
5: medium
6: medium to dark
7: dark
8: dark to very dark
9: very dark

## 24 Root: colour of core compared to colour of cortex

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties. Prepare longitudinal sections of the carrots.

**Notes and states of expression:**
1: lighter
2: same
3: darker

## 25 Root: extent of green coloration of interior (in longitudinal section)

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation. Calibrate using example varieties. Prepare longitudinal sections of the carrots.

**Notes and states of expression:**
1: absent or very small
2: very small to small
3: small
4: small to medium
5: medium
6: medium to large
7: large
8: large to very large
9: very large

1: absent or very small 5: medium 7: strong

## 26 Root: protrusion above soil

**Grouping characteristic:** no.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Stage of observation:** At the stage of harvest maturity, but before harvesting.

**Method of observation:** Visual observation. Calibrate using example varieties.

**Notes and states of expression:**
1: very small
2: very small to small
3: small
4: small to medium
5: medium
6: medium to large
7: large
8: large to very large
9: very large

## 26 Root: protrusion above soil

1: absent or very small

2: very small tot small

3: small

5: medium

7: large

## 27 Varieties with blunt tip only: Root: time of development of rounded tip

**Grouping characteristic:** no.

**Type of observation**: **MS** – Calculated average of the measurement of 40 plants or parts of plants.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation of harvested carrots. Calibrate using example varieties.

**Notes and states of expression:**
1: very early
2: very early to early
3: early
4: early to medium
5: medium
6: medium to late
7: late
8: late to very late
9: very late

**CPVO explanation:**
In order to assess these characteristics the roots should be harvested several times, more or less three times in three or four weeks before the normal maturity date of the varieties.
The earliness of carrot varieties can be judged according to two criteria, characteristic 27, time of development of “rounded tip” for the varieties with a blunt tip at maturity and characteristic 28, time of coloration of the tip in longitudinal section.
Three weeks before the normal maturity date of the varieties (where the variety ‘Touchon’ has a blunt tip): pull up of part of the test roots in order to judge the shape of the tip, characteristic 27 (early: blunt tip: variety ‘Touchon’; medium: intermediate tip: varieties ‘Tiana’, ‘Nantaise améliorée 2’, ‘Nantaise améliorée 3’; late: pointed tip: varieties ‘Bureau’, ‘Tancar’, ‘Nantaise améliorée 7’).
Following longitudinal cutting of the roots: examination of the coloration of the tip, characteristic 28 (early: coloured tip: varieties ‘Amsterdam 2’, ‘Amsterdam 3’, late: whitish tip: varieties ‘De Colmar à coeur rouge 2’, ‘Touchon’).
A good example of the difference in earliness according to the two characteristics is the variety ‘Touchon’, which is early for characteristic 27 and late for characteristic 28.

## 28 Root: time of coloration of tip

**Grouping characteristic:** yes.

**Type of observation**: **MS** – Calculated average of the measurement of 40 plants or parts of plants.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** At the stage of harvest maturity.

**Method of observation:** Visual observation of harvested carrots. Calibrate using example varieties.

**Notes and states of expression:**
1: very early
2: very early to early
3: early
4: early to medium
5: medium
6: medium to late
7: late
8: late to very late
9: very late

**CPVO explanation:**
In order to assess these characteristics the roots should be harvested several times, more or less three times in three or four weeks before the normal maturity date of the varieties.
The earliness of carrot varieties can be judged according to two criteria, characteristic 27, time of development of “rounded tip” for the varieties with a blunt tip at maturity and characteristic 28, time of coloration of the tip in longitudinal section.
Three weeks before the normal maturity date of the varieties (where the variety ‘Touchon’ has a blunt tip): pull up of part of the test roots in order to judge the shape of the tip, characteristic 27 (early: blunt tip: variety ‘Touchon’; medium: intermediate tip: varieties ‘Tiana’, ‘Nantaise améliorée 2’, ‘Nantaise améliorée 3’; late: pointed tip: varieties ‘Bureau’, ‘Tancar’, ‘Nantaise améliorée 7’).
Following longitudinal cutting of the roots: examination of the coloration of the tip, characteristic 28 (early: coloured tip: varieties ‘Amsterdam 2’, ‘Amsterdam 3’, late: whitish tip: varieties ‘De Colmar à coeur rouge 2’, ‘Touchon’).
A good example of the difference in earliness according to the two characteristics is the variety ‘Touchon’, which is early for characteristic 27 and late for characteristic 28.

## 29 Plant: height of primary umbel at time of its flowering

**Grouping characteristic:** no.

**Type of observation**: **VG** – Single visual assessment of a group of plants or parts of plants; in practice a single assessment of an average single plant or part of plant.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** Perform observation when the primary umbel is flowering.

**Method of observation:** Measure and calibrate using example varieties.

**Notes and states of expression:**
1: very low
2: very low to low
3: low
4: low to medium
5: medium
6: medium to high
7: high
8: high to very high
9: very high

Primary umbel (arrow).

## 30 Plants: proportion of male sterile plants

**Grouping characteristic:** no.

**Type of observation**: **VS** – Calculated average of the individual assessments of 40 plants or parts of plants.

**Type of characteristic**: **QN** – Quantitative characteristic.

**Stage of observation:** When all plants in the trial plot are flowering.

**Method of observation:** Observe plant by plant using the CPVO explication below. **Note:** The fertile plants produce pollen, the sterile ones do not.

**Notes and states of expression:**

| | |
|---|---|
| 1: absent or very low | Nantes 2, Touchon |
| 2: intermediate | |
| 3: high | Nanco, Tino |

**CPVO explanation:**

Absent or very low: similar or less than 20% (of the total number of plants)
Intermediate: 21-79% (of the total number of plants)
High: more than 80 % (of the total number of plants)

## 30 Plants: proportion of male sterile plants

1: absent (plant with fertile anthers containing pollen)

3: high (plant with sterile petaloid anthers)

## 31 Plant: type of male sterility

**Grouping characteristic:** no.

**Type of characteristic**: **QL** – Qualitative characteristic.

**Type of observation**: **VS** – Calculated average of the individual assessments of 40 plants or parts of plants.

**Stage of observation:** When all plants in the trial plot are flowering.

**Method of observation:** Perform a visual observation of each plant individually and assess the type of male sterility.

**Notes and states of expression:**

| | |
|---|---|
| 1: brown anthers | Nanco |
| 2: petaloid anthers | Tino |

## 31 Plant: type of male sterility

1: brown anthers

2: petaloid anthers

## Notes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