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English
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European Union
Community Plant Variety Office

PROTOCOL FOR DISTINCTNESS, UNIFORMITY AND STABILITY TESTS

***Humulus lupulus* L.**

HOP

UPOV Species Code: HUMUL_LUP

Adopted on 15/11/2006

I SUBJECT OF THE PROTOCOL

The protocol describes the technical procedures to be followed in order to meet the Council Regulation 2100/94 on Community Plant Variety Rights. The technical procedures have been agreed by the Administrative Council and are based on general UPOV Document TG/1/3 and UPOV Guideline TG/227/1 dated 05/04/2006 for the conduct of tests for Distinctness, Uniformity and Stability. This protocol applies for all varieties of ***Humulus lupulus*** **L**.

II SUBMISSION OF SEED AND OTHER PLANT MATERIAL

1. The Community Plant Variety Office (CPVO) is responsible for informing the applicant of

   - the closing date for the receipt of plant material;
   - the minimum amount and quality of plant material required;
   - the examination office to which material is to be sent.

   A sub-sample of the material submitted for test will be held in the variety collection as the definitive sample of the candidate variety.

   The applicant is responsible for ensuring compliance with any customs and plant health requirements.

2. Final dates for receipt of documentation and material by the Examination Office

   The final dates for receipt of requests, technical questionnaires and the final date or submission period for plant material will be decided by the CPVO and each Examination Office chosen.

   The Examination Office is responsible for immediately acknowledging the receipt of requests for testing, and technical questionnaires. Immediately after the closing date for the receipt of plant material the Examination Office should inform the CPVO whether acceptable plant material has been received or not. However if unsatisfactory plant material is submitted the CPVO should be informed as soon as possible.

3. Plant material requirements

   The current quality and quantity requirements as well as the final dates for submission of the plant material are available on the CPVO website (www.cpvo.europa.eu) and are published in the CPVO gazette ‘S2’.

Quality of plants:	Should not be less than the standards laid down in Council Directive 2000/29/EC and its amendments concerning organisms impairing quality, at the date of adoption of this protocol; please refer to "Eur-Lex" for the full text and in case of any subsequent amendments to the aforesaid Directive.
Chemical treatment:	The plant material must not have undergone any treatment unless the CPVO and the examination office allow or request such treatment. If it has been treated, full details of the treatment must be given.
Labelling of individual plants in sample:	- Species - File number of the application allocated by the CPVO - Breeder's reference - Examination office's reference (if known) - Name of applicant - The phrase "On request of the CPVO"

III CONDUCT OF TESTS

1. Variety collection

A variety collection will be maintained for the purpose of establishing distinctness of the candidate varieties in test. A variety collection may contain both living material and descriptive information. A variety will be included in a variety collection only if plant material is available to make a technical examination.

Pursuant to Article 7 of Council Regulation No. 2100/94, the basis for a collection should be the following:

- varieties listed or protected at the EU level or at least in one of the EEA Member States;
- varieties protected in other UPOV Member States;
- any other variety in common knowledge.

The composition of the variety collection in each Examination Office depends on the environmental conditions in which the Examination Office is located.

Variety collections will be held under conditions which ensure the long term maintenance of each accession. It is the responsibility of Examination Offices to replace reference material which has deteriorated or become depleted. Replacement material can only be introduced if appropriate tests confirm conformity with the existing reference material. If any difficulties arise for the replacement of reference material, Examination Offices must inform the CPVO. If authentic plant material of a variety cannot be supplied to an Examination Office the variety will be removed from the variety collection.

2. Material to be examined

Candidate varieties will be directly compared with other candidates for Community plant variety rights tested at the same Examination Office, and with appropriate varieties in the variety collection. When necessary an Examination Office may also include other candidates and varieties. Examination Offices should therefore make efforts to co-ordinate the work with other Offices involved in DUS testing of hop. There should be at least an exchange of technical questionnaires for each candidate variety, and during the test period, Examination Offices should notify each other and the CPVO of candidate varieties which are likely to present problems in establishing distinctness. In order to solve particular problems Examination Offices may exchange plant material.

3. Characteristics to be used

The characteristics to be used in DUS tests and preparation of descriptions shall be those referred to in the Annex 1. All the characteristics shall be used, providing that observation of a characteristic is not rendered impossible by the expression of any other characteristic, or the expression of a characteristic is prevented by the environmental conditions under which the test is conducted. In the latter case, the CPVO should be informed. In addition the existence of some other regulation e.g. plant health, may make the observation of the characteristic impossible.

The Administrative Council empowers the President, in accordance with Article 23 of Commission Regulation N° 1239/95, to insert additional characteristics and their expression in respect of a variety.

4. Grouping of varieties

The varieties and candidates to be compared will be divided into groups to facilitate the assessment of distinctness. Characteristics which are suitable for grouping purposes are those which are known from experience not to vary, or to vary only slightly, within a variety and which in their various states of expression are fairly evenly distributed throughout the collection. In the case of continuous grouping characteristics overlapping states of expression between adjacent groups is required to reduce the risks of incorrect allocation of candidates to groups. The characters used for grouping could be the following:

a) Main shoot: anthocyanin coloration (characteristic 1)

b) Plant: growth type (characteristic 7)

c) Time of picking maturity of cones (characteristic 16)

d) Cone: degree of opening of bracts (characteristic 19)

5. Trial designs and growing conditions

The minimum duration of tests (independent growing cycles) will normally include at least two satisfactory crops of fruit. Tests will be carried out under conditions ensuring normal growth. The size of the plots will be such that plants or parts of plants may be removed for measuring and counting without prejudice to the observations which must be made up to the end of the growing period.

The test design is as follows

Each test should include 10 plants.

Unless otherwise indicated, all observations should be made on 10 plants or parts taken from each of 10 plants.

Characteristics 1 to 5: Dwarf types should be observed at a comparable stage of development to that of normal types.

Leaves: Unless otherwise indicated, all observations on leaves should be made on fully developed leaves of the main shoot.

Cones and bracts: Unless otherwise indicated, all observations on cones and bracts should be made on the largest fully developed seedless cones from the head of plant (upper fifth of the plant).

6. Special tests

In accordance with Article 83(3) of Council Regulation No. 2100/94 an applicant may claim either in the Technical Questionnaire or during the test that a candidate has a characteristic which would be helpful in establishing distinctness. If such a claim is made and is supported by reliable technical data, a special test may be undertaken providing that a technically acceptable test procedure can be devised.

Special tests will be undertaken, with the agreement of the President of CPVO, where distinctness is unlikely to be shown using the characters listed in the protocol.

7. Standards for decisions

a) **Distinctness**

A candidate variety will be considered to be distinct if it meets the requirements of Article 7 of Council Regulation No. 2100/94.

b) **Uniformity**

A candidate will be considered to be sufficiently uniform if the number of off-types does not exceed the number of plants as indicated in the table below. A population standard of 1% and an acceptance probability of 95% should be applied.

Table of maximum numbers of off-types allowed for uniformity standards.

Number of plants	off-types allowed
6-35	1

c) **Stability**

A candidate will be considered to be sufficiently stable when there is no evidence to indicate that it lacks uniformity.

IV REPORTING OF RESULTS

After each recording season the results will be summarised and reported to the CPVO in the form of a UPOV model interim report in which any problems will be indicated under the headings distinctness, uniformity and stability. Candidates may meet the DUS standards after two fruiting periods but in some cases three fruiting periods may be required. When tests are completed the results will be sent by the Examination Office to the CPVO in the form of a UPOV model final report.

If it is considered that the candidate complies with the DUS standards, the final report will be accompanied by a variety description in the format recommended by UPOV. If not the reasons for failure and a summary of the test results will be included with the final report.

The CPVO must receive interim reports and final reports by the date agreed between the CPVO and the examination office.

Interim reports and final examination reports shall be signed by the responsible member of the staff of the Examination Office and shall expressly acknowledge the exclusive rights of disposal of CPVO.

V LIAISON WITH THE APPLICANT

If problems arise during the course of the test the CPVO should be informed immediately so that the information can be passed on to the applicant. Subject to prior agreement, the applicant may be directly informed at the same time as the CPVO particularly if a visit to the trial is advisable.

The interim report as well as the final report shall be sent by the Examination Office to the CPVO.

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VI - TABLE OF CHARACTERISTICS TO BE USED IN DUS-TEST AND PREPARATION OF DESCRIPTIONS

CPVO N°	UPOV N°	Characteristics	Stage, Method[1]	Examples[2]	Note
1.	**1.**	**Main shoot: anthocyanin coloration**	37-38		
(+)	**(+)**	absent or very weak	VG	Late Cluster	1
	(*)	weak		Willamette	3
QN	**QN**	medium		Spalter	5
		strong		Northern Brewer	7
G		very strong		Wye Challenger	9
2.	**2.**	**Leaf: size of blade**	37-38		
	(*)	small	VG	First Gold	3
QN	**QN**	medium		Northern Brewer	5
		large		Nugget	7
3.	**3.**	**Leaf: blistering of upper side of blade**	37-38		
	(*)	absent or very weak	VG		1
QN	**QN**	weak		Columbus	3
		medium		Perle	5
		strong			7
4.	**4.**	**Leaf: colour of upper side of blade**	37-38		
		yellow	VG	Diva	1
PQ	**PQ**	yellow green		Comet	2
		green		Brewers Gold, Wye Target	3

[1] The optimum stage of observation is explained in Annex 1 in 'Explanations and Methods'. The sample size and the method of observation for each characteristic are indicated by numbers and letters. Explanations are given in Annex 1 in 'Explanations and Methods'

[2] For certain characteristics, different example varieties, separated by a semicolon, are indicated for winter oats and spring oats. Where spring oats varieties are indicated they follow the semicolon. Example varieties are given as an indication, others may be used.

CPVO N°	UPOV N°	Characteristics	Stage, Method[1]	Examples[2]	Note
5.	**5.**	**<u>Only green varieties</u>: Leaf: intensity of green colour of upper side of blade**	37-38		
	(*)	light	VG	Brewers Gold	3
QN	**QN**	medium		Nugget	5
		dark		Wye Target	7
6.	**6.**	**Time of flowering**	67		
(+)	**(+)**	early	MG	Northern Brewer	3
	(*)	medium		Wye Target	5
QN	**QN**	late		Hersbrucker Spät	7
7.	**7. (*)**	**Plant: growth type**	87-89		
QL	**QL**	dwarf	VG	First Gold	1
G		normal		Hallertauer Magnum	2
8.	**8.**	**Plant: shape**	87-89		
(+)	**(+)**	fusiform	VG	Northern Brewer	1
		fusiform to cylindrical		Hallertauer Taurus	2
PQ	**PQ**	cylindrical		Hallertauer Magnum	3
		cylindrical to club-shaped		Willamette	4
		club-shaped		Glacier	5
		cylindrical to conic		First Gold	6
		conic			7
9.	**9.**	**Plant: volume of head**	87-89		
(+)	**(+)**	very low	VG	First Gold	1
	(*)	low		Spalter	3
QN	**QN**	medium		Saphir	5
		high		Nugget	7
		very high		Spalter Select	9

CPVO N°	UPOV N°	Characteristics	Stage, Method[1]	Examples[2]	Note
10.	**10.**	**Side shoot from <u>middle third</u> of plant: length**	87-89		
	(*)	short	VG	First Gold	3
QN	**QN**	medium		Northern Brewer	5
		long		Tettnanger	7
		very long		Late Cluster	9
11.	**11.**	**Side shoot from <u>upper third</u> of plant: length**	87-89		
	(*)	short	VG	Northern Brewer	3
QN	**QN**	medium		Columbus	5
		long		Brewers Gold	7
12.	**12.**	**Side shoot from <u>middle third</u> of plant: density of foliage**			
(+)	**(+)**	low			3
	(*)	medium		Fuggle	5
QN	**QN**	high		Northern Brewer	7
13.	**13.**	**Side shoot from <u>middle third</u> of plant: number of cones per node**	87-89		
(+)	**(+)**	few	VG	Spalter	3
	(*)	medium		Hallertauer Merkur	5
QN	**QN**	many		Perle	7
14.	**14.**	**Side shoot from <u>middle third</u> of plant: total number of cones**	87-89		
(+)	**(+)**	few	VG	Herald	3
	(*)	medium		Hallertauer Magnum	5
QN	**QN**	many		Brewers Gold	7

CPVO N°	UPOV N°	Characteristics	Stage, Method[1]	Examples[2]	Note
15.	**15.**	**Side shoot from <u>upper third</u> of plant: total number of cones**	87-89		
(+)	**(+)**	very few	VG	Herald	1
	(*)	few		Spalter	3
QN	**QN**	medium		Tettnanger	5
		many		Aurora	7
		very many		Hersbrucker Spät	9
16. **(+)**	**16.** **(+)**	**Time of picking maturity of cones**	89		
	(*)	early	MG	Northern Brewer	3
QN	**QN**	medium		Hallertauer Merkur	5
G		late		Nugget	7
17.	**17.**	**Cone: size**	89		
	(*)	small	VG	Saphir	3
		medium		Hersbrucker Spät	5
QN	**QN**	large		Tettnanger	7
18.	**18.**	**Cone: shape**	89		
(+)	**(+)**	cylindrical	VG	Wye Target	1
	(*)	narrow ovate		Northern Brewer	2
PQ	**PQ**	medium ovate		Nugget	3
		broad ovate		Brewers Gold	4
		globose			5
19.	**19.**	**Cone: degree of opening of bracts**	89		
	(*)	closed	VG	Wye Target	1
QN	**QN**	slightly open		Perle	2
G		clearly open		Brewers Gold	3

CPVO N°	UPOV N°	Characteristics	Stage, Method[1]	Examples[2]	Note
20.	**20.**	**Cone: intensity of green colour**	89		
	(*)	light	VG	Admiral	3
QN	**QN**	medium		Wye Challenger	5
		dark		Wye Target	7
21.	**21.**	**Bract: size**	89		
	(*)	small	VG	Saphir	3
QN	**QN**	medium		Northern Brewer	5
		large		Herald	7
22.	**22.**	**Bract: ratio width/length**	89		
(+)	**(+)**	small	VG		3
	(*)	medium		Aurora	5
QN	**QN**	large		Wye Target	7
23.	**23.**	**Bract: length of apex**	89		
(+)	**(+)**	very short	VG		1
	(*)	short		Wye Target	3
QN	**QN**	medium		Perle	5
		long		Brewers Gold	7
		very long			9

ANNEXES TO FOLLOW

ANNEX I

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Legend:

QL Qualitative characteristic
QN Quantitative characteristic
PQ Pseudo-qualitative characteristic

MG single measurement of a group of plants or parts of plants
VG visual assessment by a single observation of a group of plants or parts of plants

(+) See Explanations on the Table of Characteristics

37-89 See Explanations on the Table of Characteristics

Phenological growth stages and BBCH-identification keys of Hop 16

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ANNEX II

Technical Questionnaire

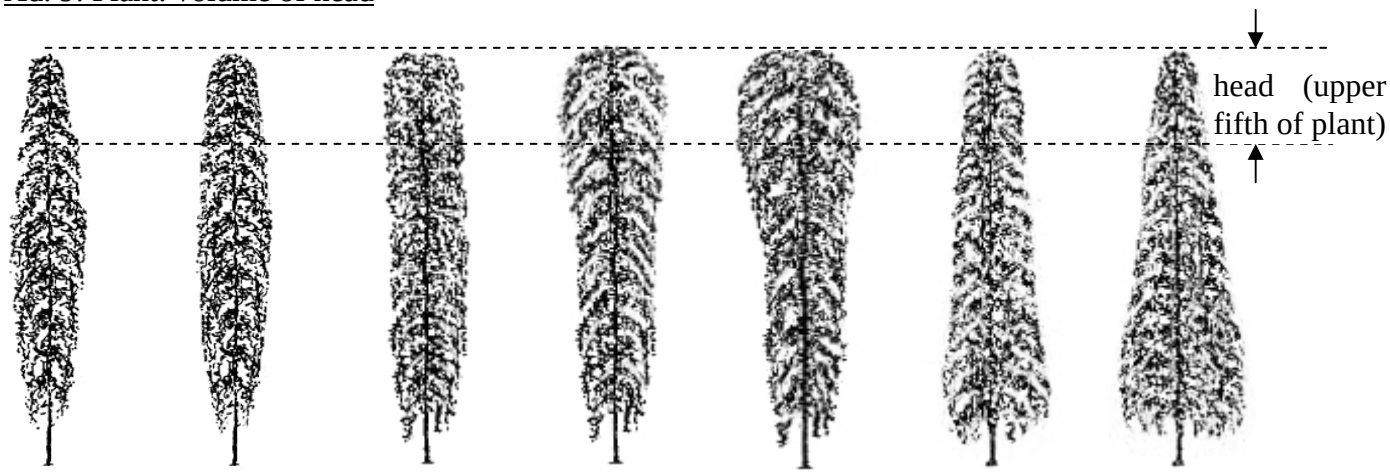
ANNEX I

EXPLANATIONS AND METHODS

Ad. 6: Time of flowering

Approximately 70% of flowers open on 50% of plants.

Ad. 8: Plant: shape
Ad. 9: Plant: volume of head



"Plant: volume of head" is related to "Plant: shape" but there is also clear variation of head volume within the same shape. The same volume of head can be observed in different shapes. Therefore, both characteristics should be observed.

Ad. 12: Side shoot from middle third of plant: density of foliage

Observation in the middle third of side shoots. The total appearance of leaves of the side shoots should be observed without considering number and size of leaves separately.

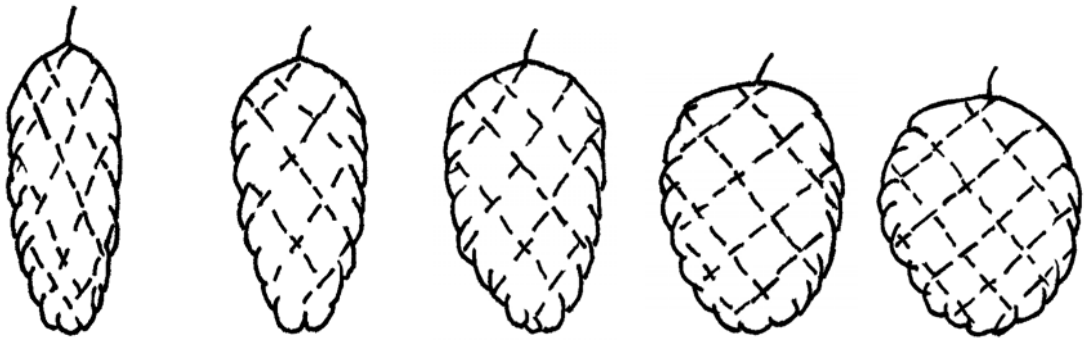
Ad. 13: Side shoot from middle third of plant: number of cones per node
Ad. 14: Side shoot from middle third of plant: total number of cones
Ad. 15: Side shoot from upper third of plant: total number of cones

The number of cones on side shoots can vary within plants. Therefore, side shoots from the middle and the upper third of plant should be considered separately (char. 14 and 15). In addition, a difference in the number of cones per node can be observed (char. 13). The number of cones per node should be assessed in the middle part of side shoots from the middle third of plant.

Ad 16: Time of picking maturity of cones

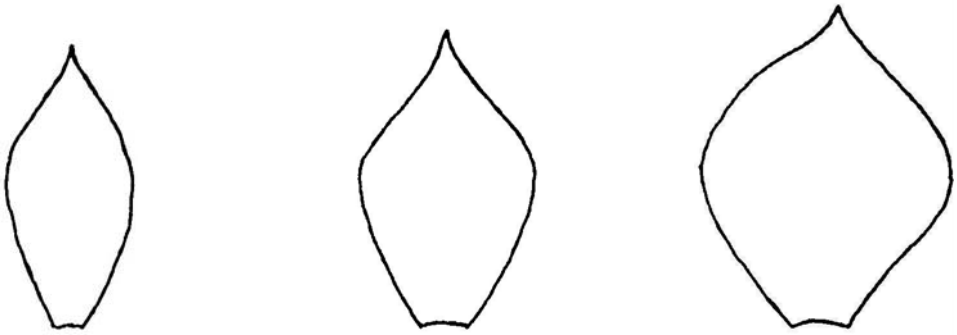
To be observed when almost all cones have reached the final degree of opening of bracts and have produced golden lupulin and fully developed aroma. The cones rustle when lightly pressed between fingers.

Ad. 18: Cone: shape



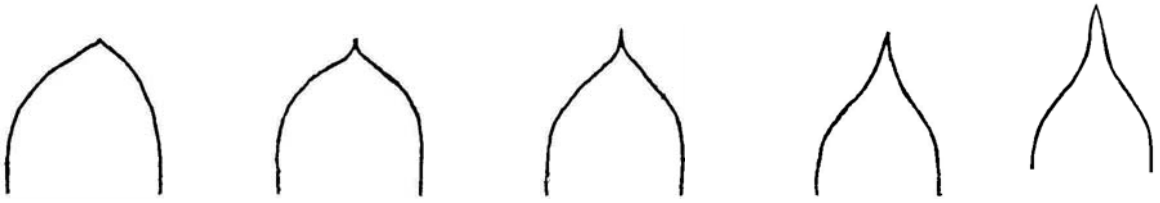
1	2	3	4	5
cylindrical	narrow ovate	medium ovate	broad ovate	globose

Ad. 22: Bract: ratio width/length



3	5	7
small	medium	large

Ad. 23: Bract: length of apex



1	3	5	7	9
very short	short	medium	long	very long

Phenological growth stages and BBCH-identification keys of Hop (*Humulus lupulus* L.), Rossbauer et al., 1995

Code	*Description*
Principal growth stage 0	**Sprouting**
00	Dormancy: Rootstock without shoots (uncut)
01	Dormancy: Rootstock without shoots (cut)
07	Rootstock with shoots (uncut)
08	Beginning of shoot-growth (rootstock cut)
09	Emergence: First shoots emerge at the soil surface
Principal growth stage 1	**Leaf development**
11	First pair of leaves unfolded
12	Second pair of leaves unfolded (Beginning of twining)
	stages continuous till ...
19	Nine and more pairs of leaves unfolded
Principal growth stage 2	**Formation of side shoots**
21	First pair of side shoots visible
22	Second pair of side shoots visible
	stages continuous till ...
29	Nine and more pairs of side shoots visible (secondary side shoots occur)
Principal growth stage 3	**Elongation of bines**
31	Bines have reached 10 % of top wire height
32	Bines have reached 20 % of top wire height
	stages continuous till ...
38	Plants have reached the top wire
39	End of bine elongation
Principal growth stage 4	-
Principal growth stage 5	**Inflorescence emergence**
51	Inflorescence buds visible
55	Inflorescence buds enlarged
Principal growth stage 6	**Flowering**
61	Beginning of flowering: about 10 % of flowers open
65	Full flowering: about 50 % of flowers open
69	End of flowering
Principal growth stage 7	**Development of cones**
71	Beginning of cone development: 10 % of inflorescences are cones
75	Cone development half way: All cones are visible, cones are soft, stigmas still present
79	Cone development complete: Cones have reached full size
Principal growth stage 8	**Maturity of cones**
81	Beginning of maturity: 10 % of cones are compact
85	Advanced maturity: 50 % of cones are compact
87	70 % of cones are compact
89	Cones ripe for picking: cones closed; lupulin golden; aroma potential fully developed
Principal growth stage 9	**Senescence, entry into dormancy**
92	Overripeness: Cones yellow-brown discolored, aroma deterioration
97	Dormancy: leaves and stems dead

LITERATURE

Meier, U. (Editor), 1997: Growth Stages of Mono- and Dicotyledonous Plants. BBCH-Monograph. Blackwell Wissenschafts-Verlag, Berlin, Wien.

ANNEX II

European Union
Community Plant Variety Office

TECHNICAL QUESTIONNAIRE

to be completed in connection with an application for Community Plant Variety Rights
Please answer all questions. A question without any answer will lead to a non-attribution of an application date. In cases where a field / question is not applicable, please state so.

1. **Botanical taxon:** Name of the genus, species or sub-species to which the variety belongs and common name

***Humulus lupulus* L.**

HOP

2. **Applicant(s):** Name(s) and address(es), phone and fax number(s), Email address, and where appropriate name and address of the procedural representative

3. **Variety denomination**

a) Where appropriate proposal for a variety denomination:

b) Provisional designation (breeder's reference):

4. Information on origin, maintenance and reproduction of the variety

4.1 Breeding scheme

Variety resulting from:

4.1.1 Crossing

(a) controlled cross (please state parent varieties)..... [ ]

(b) partially known cross (please state know parent variety) ..... [ ]

(c) unknown cross:..... [ ]

4.1.2 Mutation ..... [ ]
(please state parent variety)

4.1.3 Discovery and development ..... [ ]
(please state where and when discovered and how developed)

4.1.4 Other (please provide details)..... [ ]

4.2 Method of propagation

4.2.1 Vegetative propagation

(a) budding or grafting ..... [ ]

(b) other (state method) ..... [ ]

4.2.2 Other (please provide details) ..... [ ]

4.3 Geographical origin of the variety: the region and the country in which the variety was bred or discovered and developed

5. Characteristics of the variety to be indicated (the number in brackets refers to the corresponding characteristic in the CPVO Protocol; please mark the state of expression which best corresponds).

Characteristics		Example varieties	Note
5.1 (1)	**Main shoot: anthocyanin coloration**		
	absent or very weak	Late Cluster	1 [ ]
	weak	Willamette	3 [ ]
	medium	Spalter	5 [ ]
	strong	Northern Brewer	7 [ ]
	very strong	Wye Challenger	9 [ ]
5.2 (7)	**Plant: growth type**		
	dwarf	First Gold	1 [ ]
	normal	Hallertauer Magnum	2 [ ]

	Characteristics	Example varieties	Note
5.3 (10)	**Side shoot from <u>middle third</u> of plant: length**		
	short	First Gold	3 [ ]
	medium	Northern Brewer	5 [ ]
	long	Tettnanger	7 [ ]
	very long	Late Cluster	9 [ ]
5.4 (15)	**Side shoot from <u>upper third</u> of plant: total number of cones**		
	very few	Herald	1 [ ]
	few	Spalter	3 [ ]
	medium	Tettnanger	5 [ ]
	many	Aurora	7 [ ]
	very many	Hersbrucker Spät	9 [ ]
5.5 (16)	**Time of picking maturity of cones**		
	early	Northern Brewer	3 [ ]
	medium	Hallertauer Merkur	5 [ ]
	late	Nugget	7 [ ]
5.6 (17)	**Cone: size**		
	small	Saphir	3 [ ]
	medium	Hersbrucker Spät	5 [ ]
	large	Tettnanger	7 [ ]
5.7 (19)	**Cone: degree of opening of bracts**		
	closed	Wye Target	1 [ ]
	slightly open	Perle	2 [ ]
	clearly open	Brewers Gold	3 [ ]

Characteristics		Example varieties	Note
5.8 (23)	**Bract: length of apex**		
	very short		1 [ ]
	short	Wye Target	3 [ ]
	medium	Perle	5 [ ]
	long	Brewers Gold	7 [ ]
	very long		9 [ ]

6. Similar varieties and differences from these varieties:

Denomination of similar variety	Characteristic in which the similar variety is different[1)]	State of expression of similar variety	State of expression of candidate variety

[1)] In the case of identical states of expressions of both varieties, please indicate the size of the difference

7. Additional information which may help to distinguish the variety

7.1 Resistance to pests and diseases

7.2 Special conditions for the examination of the variety

[ ] YES, please specify

[ ] NO

7.3 Type of use

- Aroma..... [ ]
- Bitter..... [ ]
- High Alpha ..... [ ]
- Ornamental ..... [ ]
- Other (please specify)..... [ ]

7.4 Other information

[ ] YES, please specify

[ ] NO

8. GMO-information required

The variety represents a Genetically Modified Organism within the meaning of Article 2(2) of Council Directive EC/2001/18 of 12/03/2001.

[ ] YES [ ] NO

If yes, please add a copy of the written attestation of the responsible authorities stating that a technical examination of the variety under Articles 55 and 56 of the Basic Regulation does not pose risks to the environment according to the norms of the above-mentioned Directive.

9. Information on plant material to be examined

9.1 The expression of a characteristic or several characteristics of a variety may be affected by factors, such as pests and disease, chemical treatment (e.g. growth retardants or pesticides), effects of tissue culture, different rootstocks, scions taken from different growth phases of a tree, etc.

9.2 The plant material should not have undergone any treatment which would affect the expression of the characteristics of the variety, unless the competent authorities allow or request such treatment. If the plant material has undergone such treatment, full details of the treatment must be given. In this respect, please indicate below, to the best of your knowledge, if the plant material to be examined has been subjected to:

(a) Microorganisms (e.g. virus, bacteria, phytoplasma)	[ ] Yes	[ ] No
(b) Chemical treatment (e.g. growth retardant or pesticide)	[ ] Yes	[ ] No
(c) Tissue culture	[ ] Yes	[ ] No
(d) Other factors	[ ] Yes	[ ] No

Please provide details of where you have indicated "Yes":

I/we hereby declare that to the best of my/our knowledge the information given in this form is complete and correct.

Date Signature Name

[End of document]