



Types of characteristics and their scale levels in the official variety testing

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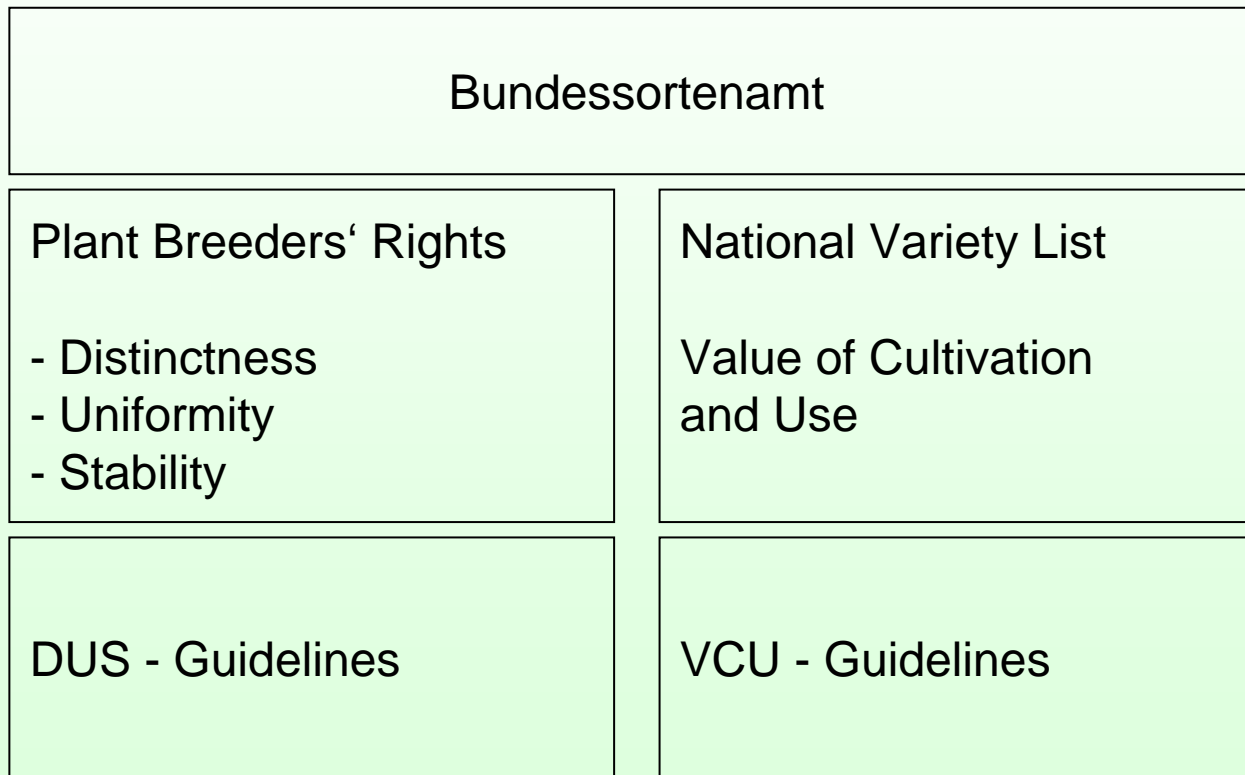
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Introduction





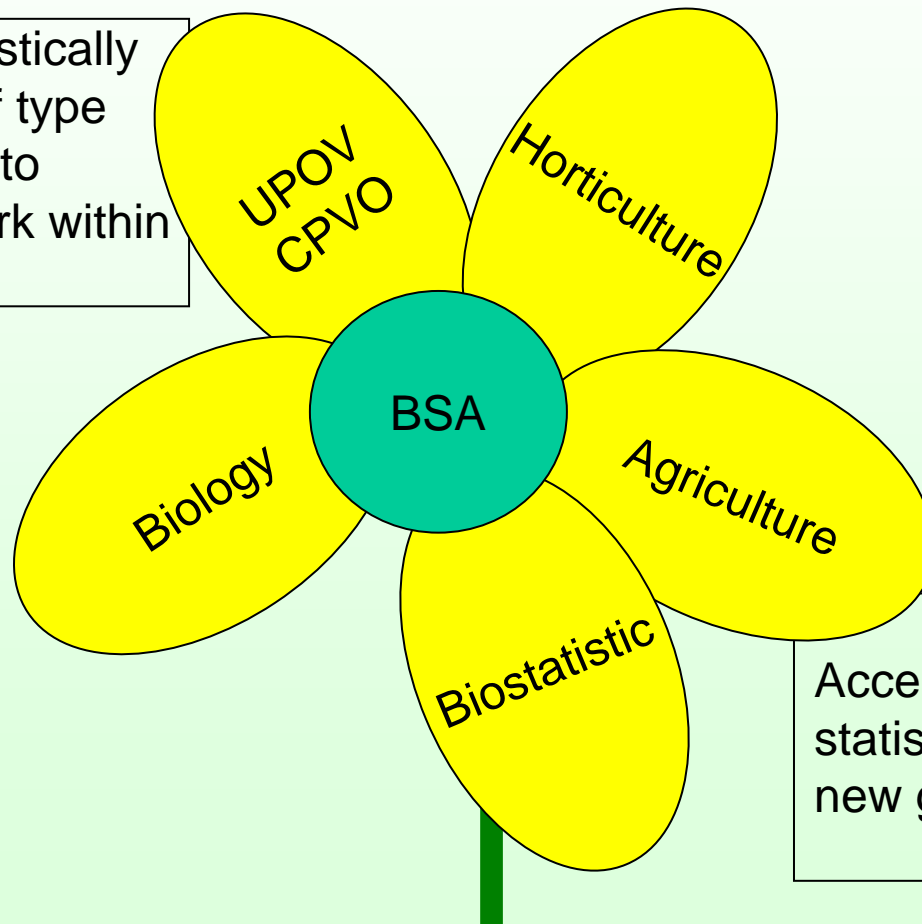
National and international Guidelines

- Bundessortenamt (BSA) based in Hanover (Germany)
 - National Guidelines (DUS und VCU)
- European Union Plant Variety Office (CPVO) based in Angers (France)
 - DUS - Guidelines for EU member states
- International Union for the Protection of New Varieties of Plants (UPOV) based in Geneva (Switzerland)
 - DUS - Guidelines for UPOV member states



Main reasons for the work

Introduction of statistically based definitions of type of characteristics into interdisciplinary work within UPOV and CPVO



Acceptance of additional statistical information into new guidelines



Definition of different process levels to consider characteristics

Process level	Description of the process level	
1	Characteristics as expressed in the trial	What crop expert knows, feels and sees without data
2	Data for evaluation of characteristics	Raw data of the trial
3	Variety description	Derived data



UPOV-Definition

Qualitative characteristics (QL)

“Qualitative characteristics” are those characteristics that are expressed in discontinuous states

[e.g., sex of plant:

dioecious female (1), dioecious male (2), monoecious unisexual (3), monoecious hermaphrodite (4)].

These states are self-explanatory and independently meaningful. All states are necessary to describe the full range of the characteristic, and every form of expression can be described by a single state. The order of states is not important.



UPOV-Definition

Quantitative characteristics (QN)

“**Quantitative characteristics**” are those characteristics where the expression covers the full range of variation from one extreme to the other. The expression can be recorded on a one-dimensional, continuous or discrete, linear scale. The range of expression is divided into a number of states for the purpose of description

[e.g., length of stem:

Very short (1), short (3), medium (5), long (7), very long (9)].

The division seeks to provide, as far as practical, an even distribution across the scale.



UPOV-Definition

Pseudo-Qualitative characteristics (PQ)



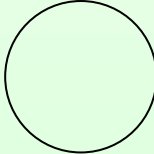

In the case of “pseudo-qualitative characteristics”, the range of expressions is at least partly continuous, but varies in more than one dimension

[e.g., shape:

ovate(1), elliptic (2), circular (3), obovate (4)]

and cannot be adequately described by just defining two ends of a linear range. In a similar way to qualitative (discontinuous) characteristics - hence the term “pseudo-qualitative” - each individual state of expression needs to be identified to adequately describe the range of the characteristic.

PQ-Characteristic Leaf: Shape

Note	Language	Expression	Explanation
1	English German	Ovate eiförmig	
2	English German	Elliptic elliptisch	
3	English German	Circular kreisförmig	
4	English German	Obovate verkehrt eiförmig	



Type of scales

- Ratio scale
- Interval scale
- Ordinal scale
- Nominal scale

Definitions are included in the abstract



Ratio Scale

Type of scale		Description	Distribution	Data recording	Scale level
Quantitative (metric)	Ratio	Constant distances with absolute zero point	Continuous	Absolute measurement	Very high
			Discrete	Counting	Very high

Typical comment:

„We don't have any plants that have a length of zero.“



Interval Scale

Type of scale		Description	Distribution	Data recording	Scale level
Quantitative (metric)	Interval	Constant Distances <i>without</i> absolute zero point	Continuous	Relative measurements	High
			Discrete	Date	High

Typical comment:

“I could establish a certain date as the absolute zero and work everything from there.”



Ordinal Scale

Type of scale		Description	Distribution	Data recording	Scale level
Qualitative with underlying quantitative variable	Ordinal	Ordered expressions with varying distances	Discrete	Visually assessed notes	Medium

Typical comment:

“Qualitative characteristics do not necessarily have a clear logical order.”



Nominal Scale

Type of scale		Description	Distribution	Data recording	Scale level
Qualitative	Nominal	No order No distances	Discrete	Visually assessed notes	Low

Typical comment:

“There are clear cuts between expressions and all expressions are significant different.”



Relation between type of expression and type of scale

Process level	Description of the process level	Example: Length of plant
1	Characteristics as expressed in the trial	Postulate: Quantitative characteristic
2	Data for evaluation of characteristics	Ratio scaled measurements or
		Ordinal scaled data by visual assessment

Literature

Info from other species

measurements not too expensive

measurements too expensive



Relation between type of expression and type of scale

Name of Characteristic	Assessment of	Unit of assessment	Type of scale
Length of plant	Distinctness	cm	Ratio scaled continuous quantitative data
		Notes: 1 : very short 5 : medium 9 : very long	Ordinal scaled qualitative data
	Uniformity	cm	Ratio scaled continuous quantitative data
		True-type/ off-type	Nominally scaled qualitative data

measurements
not too
expensive

measurements
too expensive



Scale levels for variety descriptions

Process level	Description of the process level	Scale levels			
2	Data for evaluation of characteristics	Ratio	Interval	Ordinal	Nominal
3	Variety description	↓	↓ Ordinal	↓	↓ Nominal

Transformation



Scale levels in statistical textbooks (Alternative 1)

Process level	Description of the process level					
1	Characteristics as expressed in the trial	Quantitative (QU)			Pseudo- Qualitative (PQ)	Qualitative (QL)
2	Data for evaluation of characteristics	Ratio	Interval	Ordinal	Nominal	
	Stat. textbooks (Alternative 1)	Quantitative characteristic			Qualitative characteristic	



Scale levels in statistical textbooks (Alternative 2)

Process level	Description of the process level				
1	Characteristics as expressed in the trial	Quantitative (QU)		Pseudo-Qualitative (PQ)	Qualitative (QL)
2	Data for evaluation of characteristics	Ratio	Interval	Ordinal	Nominal
	Stat. textbooks (Alternative 2)	Quantitative characteristic			Qualitative characteristic



Scale levels in statistical textbooks (Alternative 3)

Process level	Description of the process level					
1	Characteristics as expressed in the trial	Quantitative (QU)			Pseudo-Qualitative (PQ)	Qualitative (QL)
2	Data for evaluation of characteristics	Ratio	Interval	Ordinal	Nominal	
	Stat. textbooks (Alternative 3)	Quantitative characteristic		Qualitative characteristic with underlying quantitative variable	Qualitative characteristic	



Method of observation and type of record(s)



M: to be measured
(or counted)

V: to be observed visually

G: single record for a variety,
or a group of plants (n=1)

S: records for a number of
single, individual plants
(e.g. n=60)

MG

MS

VG

VS



UPOV - Technical Guideline

French Bean

TG/12/9

French Bean/Haricot/Gartenbohne/Judía común, Alubia, 2005-04-06

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7. Table of Characteristics/Tableau des caractères/Merkmalstabelle/Tabla de caracteres

	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
1.	VG Plant: anthocyanin coloration of hypocotyl	Plante: pigmentation anthocyanique de l'hypocotyle	Pflanze: Anthocyanfärbung des Hypokotyls	Planta: pigmentación antocianica del hipocótilo		
QL	<u>absent</u>	absente	fehlend	ausente	Tuf (D)	<u>1</u>
	<u>present</u>	présente	vorhanden	presente	Delinel (D), Vilbel (D)	<u>9</u>



UPOV - Technical Guideline

French Bean

TG/12/9						
<u>French Bean/Haricot/Gartenbohne/Judía común, Alubia, 2005-04-06</u>						
- 9 -						
	English	français	deutsch	español	Example Varieties/ Exemples/ Beispielssorten/ Variedades ejemplo	Note/ Nota
6.	MG/ MS/ VG	Dwarf beans only:	Haricot nain	Nur Buschbohnen:	Sólo variedades de	
		Plant: height	seulement: Plante:	Pflanze: Höhe	mata baja: Planta:	
		hauteur	hauteur	altura		
QN	<u>short</u>	petite	niedrig	baja	Goldfish (D)	<u>3</u>
	<u>medium</u>	moyenne	mittel	media	Fori (D)	<u>5</u>
	<u>tall</u>	grande	hoch	alta	Nerina (D), Rote von Paris (D)	<u>7</u>

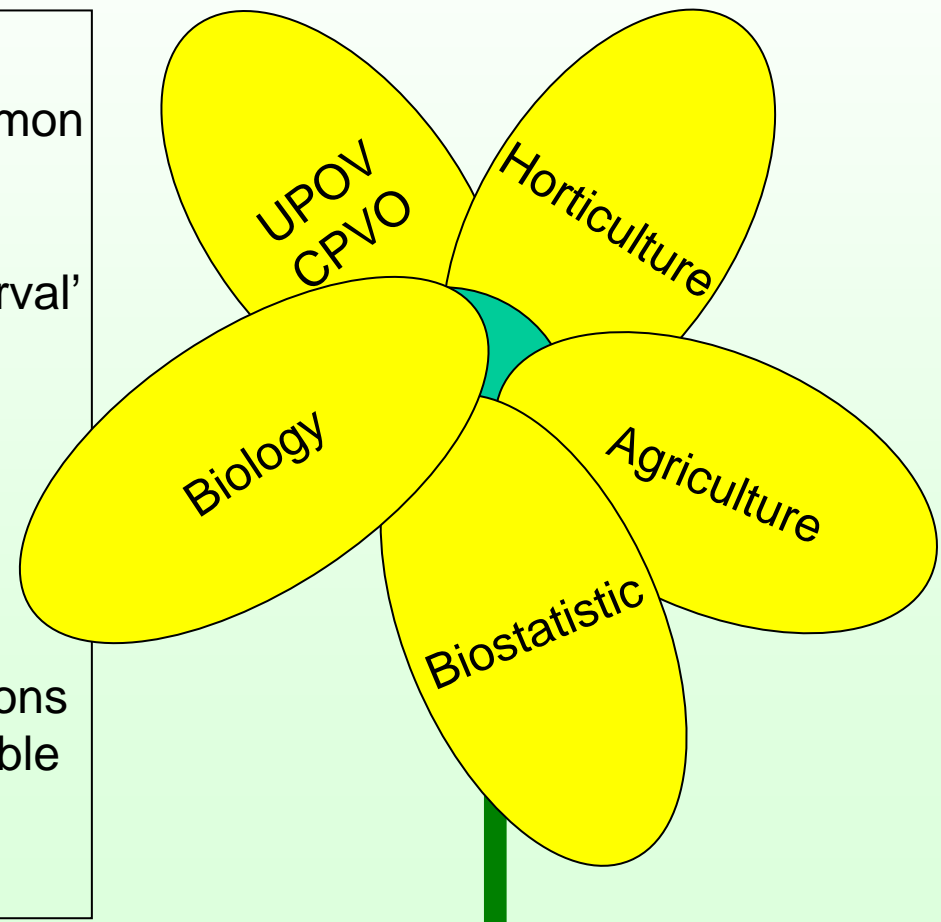


Relation between type of scale, observation method and statistical procedure

Type of scale	Distribution	Observation method for Distinctness	Statistical Procedure
Ratio	Continuous	MS	COY-D
	Discrete	MS	COY-D
Interval	Continuous	MS	COY-D
	Discrete	MS	COY-D
Ordinal	Discrete	VS	Minimum Distance (COY-D), (Threshold model)
		VG	Minimum Distance
Nominal	Discrete	VS	(Chi-square)
		VG	Minimum Distance

Conclusions

- All new technical guidelines get additional statistical information as common basis for crop experts and statisticians
- Statistical terms 'nominal', 'ordinal', 'interval' and 'ratio' were accepted in a technical guidance protocol of UPOV
- Increasing of transparency in the daily work
- Statistical analysis and variety descriptions of different countries are more comparable
- Perfecting of cooperation





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