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INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL WORKING PARTY
FOR
AGRICULTURAL CROPS

Thirty-Fourth Session
Christchurch, New Zealand, October 31 to November 4, 2005

ADDENDUM 2 TO DOCUMENT TWA/34/13

PROJECT TO CONSIDER THE PUBLICATION OF VARIETY DESCRIPTIONS:
POTATO

Document prepared by the Office of the Union

At the thirty-fourth session of the Technical Working Party for Agricultural Crops held in Christchurch, New Zealand, from October 31 to November 4, 2005, Mr. Henk Bonthuis (Netherlands), Joint Coordinator for the Model Study for Potato, made a presentation concerning the Model Study for Potato, as reported in document TWA/34/13. A copy of that presentation is presented as an Annex to this document.

[Annex follows]

ANNEX

Slide 1

Slide 2

Slide 3

Study

■ Stability of <u>Characteristics</u>
    ● Similarities / differences across different environments
    ● Patterns among descriptions from different sources
 	
■ Similarities among <u>Environments</u> for selected (groups of) characteristics
 	
■ Potential use and constraints on the <u>Publication</u> of variety descriptions

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Dataset

- Data were received from 13 countries
- Model study to be based on 325 varieties
- Covering a total number of 1180 descriptions
- 1180 out of a potential # of (13 * 325 =) 4225 descr. That is 28 % real data.
- Based on TG 23/5

# varieties	# sources
2	10
2	9
9	8
12	7
20	6
37	5
68	4
72	3
90	2
13	1
Total # varieties = 325	

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Number of common variety descriptions among countries

# cvs	# missing		NL	DE	CZ	SL	PO	AT	CA	NZ	ZA	LT	EE	UK	IL
301	24	NL	301	186	154	147	57	61	56	29	26	26	26	17	19
205	120	DE		205	107	102	40	45	23	9	7	20	18	8	10
175	149	CZ			175	126	51	47	39	18	15	22	23	10	11
160	165	SL				160	49	46	37	21	12	24	24	7	12
61	264	PO					61	18	19	10	8	18	12	4	10
63	262	AT						63	10	8	5	6	9	2	6
62	263	CA							62	16	12	8	9	12	9
31	294	NZ								31	8	3	3	5	2
29	296	ZA									29	1	1	7	2
28	297	LT										28	9	2	5
27	298	EE											27	1	3
22	303	UK												22	4
19	306	IL													19
28 %	**72 %**														

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Incomplete dataset (13 cvs. only with > 7 descriptions) ■ = missing value
(H$_0$ = similar descriptions from different sources)

	NL	DE	CZ	SL	PO	AT	CA	NZ	ZA	LT	EE	UK	IL	Total # of descr
Adora	X	X	X	X	X	X	X			X		X	X	10
Asterix	X	X	X	X	X	X	X			X	X		X	10
Mondial	X		X	X	X	X	X	X				X	X	9
Remarka	X	X	X	X	X	X	X				X		X	9
Agria	X	X	X	X		X	X	X			X			8
Carlita	X	X		X	X		X			X	X		X	8
Felsina	X	X	X	X	X		X			X			X	8
Fresco	X	X	X	X	X					X	X	X		8
Impala	X	X	X	X	X	X				X	X			8
Innovator	X		X	X	X		X	X	X	X				8
Platina	X	X	X	X	X	X	X		X					8
Van Gogh	X	X	X	X		X	X	X			X			8
Victoria	X		X	X	X		X	X	X		X			8

Slide 7
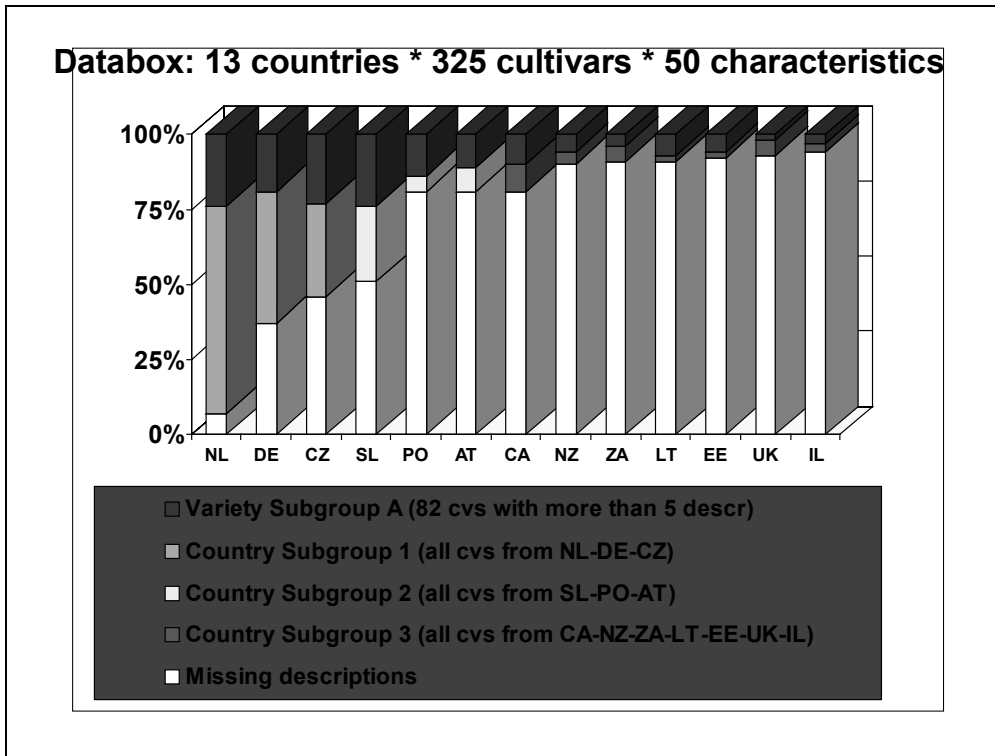
NL/DE/CZ	red/green
SL/PO/AT	red/yellow
CA/NZ/ZA/LT/EE/UK/IL	red/blue

Red: Variety Subgroup A (82 cvs with more than 5 descr)
Green: Country Subgroup 1 (all cvs from NL-DE-CZ)
Yellow: Country Subgroup 2 (all cvs from SL-PO-AT)
Blue: Country Subgroup 3 (all cvs from CA-NZ-ZA-LT-EE-UK-IL)
White: Missing descriptions

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Unbalanced dataset – without replications

sources of variation	df	SS	MS	F-test prob.
variety	324			
country	12			
variety*country = residual	843			
Total	1179			

Genstat – REML procedure = Residual maximum likelihood

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Analyses – options (H_0 = similar descr. from different sources)

- 1. Over all varieties – across a subset of 3 countries (NL-DE-CZ)
  - Condensed dataset – (slightly) unbalanced – partial concl. on major set

- 2. Over all varieties – across a subset of 5 cnt. (NL-DE-CZ-SL-PO)
  - Unbalanced dataset – coherent set of countries

- 3. Over all varieties – across all countries
  - Highly unbalanced – overall conclusions

- 4. Per variety – across countries
  - Direct comparison - no replications – few df – standard dev. – min / max

- 5. Over a subset of varieties – across countries – ringtest Poland 2005
  - Concised dataset – slightly unbalanced – partial conclusions

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Restrictions on the statistical analyses

- **Statistical variance analysis requirements**
  - Normal distribution of data
  - Constant error variance

- **Qualitative characteristics**
  - Discontinuous scale (mostly) – should be tested non-parametric

- **Pseudo Qualitative characteristics - short scales (< 1 - 9)**
  - Limited range of variance (not comparable with 1-9 scale)
  - Not always normally distributed (skew distributions and skew scales)

- **Quantitative characteristics (scale 1 – 9) – REML analysis**
  - No replications from similar sources – not always normally distributed
  - Test against interactions (small sign. differences indicate low interactions)

- **Constraints equally applicable for comparison of Standard deviations**
  - Standard deviations are relative to the range and relative to the average

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Qualitative and Pseudo-qualitative char. (# cvs.   1 state different)

Char.		* and grouping	Char-type	Char. range	# cvs with diff descr	% total # of cvs
47	Tuber: color skin	* - G	PQ	1 – 5	8	2.5
48	T: color base eye		PQ	1 – 3	8	2.5
40	Fl.: anth. white fl.	*	QL	1 / 9	22	10.2
27	Lfl.:anth. ap. roset.		QL	1 / 9	36	11.5
3	L.spr.: anth. base	* - G	QL	1 – 2	37	11.9
38	Fl.: color inner side	* - G	PQ	1 – 3	42	12.9
14	Plant: type		PQ	1 – 3	148	47.1
49	Tuber: color flesh	*	PQ	1 – 5	201	61.8
2	L.sprout: shape	*	PQ	1 – 5	231	71.1

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Differences for 'stable' QL-characteristics: X40

X40	# descr	NL	DE	CZ	SL	PO	AT	CA	NZ	ZA	LT	EE	UK	IL
Remarka	9	1	1	1	1	9	1	1				1		1
Fresco	8	1	1	1	1	1					9	1	1	
Agria	6	1		1	1		1	1				9		
Dorado	4	9		1		1				1				
Atlas	4	9	9	1	9									
Taiga	3	9	1		1									
Anosta	3			1	1							9		
Hilite Russet	3	1						1					9	
Allure	2	9	1											
Stefano	2	9	1											
Fianna	2	9						1						
Desiree	2					9								1
Felsina	8	1	9	9	1	1		1			1			1
Latona	7	1		1	9	9		1			1	1		
Sante	6	9		1	1			1			9	1		
Kuras	5	9	1	1	9		1							
Gloria	5		1	9	9	1		1						
Saturna	5		1	1	9	9	9							

X40 = Flower corolla: anthocyanin coloration of outer side of white flower

1 = absent

9 = present

**Remaining cvs
were stable**

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Interim Conclusion

- QL char. (3) are stable across environments
  - Differences for QL char. need to be checked

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Differences for 'stable' PQ-characteristics: X47

X47	NL	DE	CZ	SL	PO	AT	CA	NZ	ZA	LT	EE	UK	IL
Cleopatra	2			2			1						
Diana	2	1										2	
Glamis	1											4	
Merlin							1		4			4	
Quarta	1	4	4	1		1					1		
Rasant	1	2	2										
Redstar	2			2	2		1	2					
Russet Burbank	1					2		1	1				

X47 = Tuber: color of skin (1 – 5) - grouping char.

1 = yellow

2 = red

3 = blue

4 = red parti-colored

5 = blue part-colored

Remaining cvs. were stable

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Differences for 'stable' PQ-characteristics: X48

X48	NL	DE	CZ	SL	PO	AT	CA	NZ	ZA	LT	EE	UK	IL
Argos			1						2			1	
Cycloon	1		2	1	1								
Diana	2	1										1	
Evita	1		1	1		2							
Karakter	2	1											
Sebago	1								2				
Serenade	1	1	1						3				
Solara	2	1	2	1	1	1							

X48 = Tuber: color of the base of the eyes (1 – 3)

1 = yellow

2 = red

3 = blue

Remaining cvs. were stable

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Differences for 'stable' PQ-characteristics: X38

X38	NL	DE	CZ	SL	PO	AT	CA	NZ	ZA	LT	EE	UK	IL	Country A	Country B
28 cultivars														2	3
Romula	1	2	2	2	2										
Carrera	2		1	2	2										
Saxon	1						1	1				2			
L. Christl	2			2			1		2						
Sirius	2	1	1	1											
Platina	1					1	2		1						
Cleopatra	2			2			1								
Diana	1	2										1			
Jana	2	1	2												
Molli	3	1			1										
Verdi	1	2													
Rosella	2	2	2	2	2	1				1					
Draga	1			2			2	3							
Novita	3	2		1		1							3		

X38 = Flower corolla: color of inner side (grouping char.)

| 1 = white   2 = red-violet   3 = blue-violet |
| Remaining cvs. were stable |

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Interim Conclusion

- QL char. (3) are stable across environments
  - Differences for QL char. need to be checked
- PQ char. can be very stable and very unstable
  - Differences for stable PQ char. need to be checked
  - PQ char. can be unstable for various reasons

- Environment = environment wide sense
  - Year, location, growing cond., observer, TG interpretation etc.

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QN char.: Increasing differences for Plant height			

Central EU	Northern EU	New EU	World
			IL 4.650 a . . . .
			UK 4.912 a b . . .
			NZ 5.035 a b . . .
			ZA 5.062 a b . . .
	PO 5.152 a . . .	PO 5.180 a . . .	PO 5.199 . b . . .
CZ 5.259 a . .	CZ 5.245 a . . .	CZ 5.249 a . . .	CZ 5.243 . b . . .
		AT 5.564 . b . .	AT 5.572 . . c . .
			CA 5.631 . . c . .
		EE 5.645 . b c .	EE 5.640 . . c d .
NL 5.692 . b .	NL 5.706 . b . .	NL 5.732 . b c .	NL 5.738 . . c d .
		LT 5.761 . b c .	LT 5.800 . . c d .
	SL 5.923 . . c .	SL 5.929 . . c .	SL 5.921 . . . d .
DE 6.789 . . c	DE 6.759 . . . d	DE 6.755 . . . d	DE 6.735 . . . . e

Significant differences (P = 0.05) in Plant height (QN – scale 1-9) among descriptions

originating from 3 – 5 – 8 – 13 countries

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QN char.: Increasing differences for Leaf size			

Central EU	Northern EU	New EU	World
	PO 4.710 a . .	PO 4.727 a . . .	NZ 4.757 a . . . .
			PO 4.765 a . . . .
			UK 4.806 a b . . .
			ZA 5.334 . b c . .
	SL 5.510 . b .	SL 5.504 . b . .	SL 5.521 . . c . .
			IL 5.540 . . c d .
DE 5.598 a	DE 5.589 . b c	DE 5.547 . b . .	DE 5.564 . . c d .
CZ 5.619 a	CZ 5.626 . b c	CZ 5.632 . b c .	CZ 5.680 . . c d .
		EE 5.706 . b c .	EE 5.724 . . c d .
NL 5.829 a	NL 5.847 . . c	NL 5.869 . . c .	NL 5.886 . . . d .
		LT 6.081 . . c d	LT 6.115 . . . d e
		AT 6.139 . . . d	AT 6.179 . . . . e

Significant differences (P = 0.05) in Leaf size (QN – scale 1-9) among descriptions

originating from 3 – 5 – 8 – 13 countries

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Interim Conclusion

- QL char. (3) are stable across environments
    - Differences for QL char. need to be checked (for mistakes)
- PQ char. can be very stable and very unstable
    - Differences for stable PQ char. need to be checked
    - PQ char. can be unstable for various reasons
- Most QN char. are unstable
    - Among these QN char. there are 7 asterisked characteristics

- Environment = environment wide sense
    - Year, location, growing cond., observer, TG interpretation etc.

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Asterisked QN characteristics

- Tuber: shape
- Leaflet: size
- Flower corolla: intensity of anthocyanin coloration of inner side in colored flower
- Lightsprout: intensity of anth. coloration of base
- Stem: extension of anthocyanin coloration
- Leaflet: waviness of margin
- Lightsprout: pubescence of base

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Adora: 10 descriptions for asterisked QN characteristics

	NL	DE	CZ	SL	PO	AT	CA	LT	UK	IL	Actual Range	Avg. St.dev
Tuber: shape	3	3	3	3	2	3	4	3	3	5	3	0.6
Leaflet: size	7	6	7	6	5	7	*	7	6	7	2	0.8
Fl. cor: int. anth. Inner side	5	5	7	5	4	7	6	5	6	5	3	0.9
L.spr.: int. anth. col. base	4	6	6	5	5	3	5	4	4	7	4	1.0
Stem: ext. anth. coloration	4	3	5	6	5	3	3	4	9	2	7	1.0
Leaflet: waviness	4	5	5	3	3	3	5	4	3	9	6	1.1
L.spr: pubescence of base	4	7	2	6	6	7	3	4	7	9	7	1.1
Country effect	4.4	5.0	5.0	4.9	4.3	4.7	4.7	4.4	5.4	6.3		

Actual Range for all char. > Minimum distance = 2 sd ?

IL (and UK) are outliers.

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Asterix: 10 descriptions for asterisked QN characteristics

	NL	DE	CZ	SL	PO	AT	CA	LT	EE	IL	Actual Range	Avg. St.dev
Tuber: shape	4	2	3	4	3	4	4	3	3	5	3	0.6
Leaflet: size	4	6	6	5	3	3	*	4	4	7	4	0.8
Fl. cor: int. anth. Inner side	6	4	7	6	5	7	2	6	6	*	5	0.9
L.spr.: int. anth. col. base	6	8	6	7	7	7	9	6	6	9	3	1.0
Stem: ext. anth. coloration	6	8	7	7	5	3	5	6	6	1	7	1.0
Leaflet: waviness	7	4	7	6	5	3	4	7	7	7	4	1.1
L.spr: pubescence of base	5	5	5	6	5	7	5	5	5	5	2	1.1
Country effect	5.4	5.3	5.9	5.9	4.7	4.9	4.9	5.3	5.3	5.7		

Actual Range for all char. > 2 st. dev

Individual "off-type scores".

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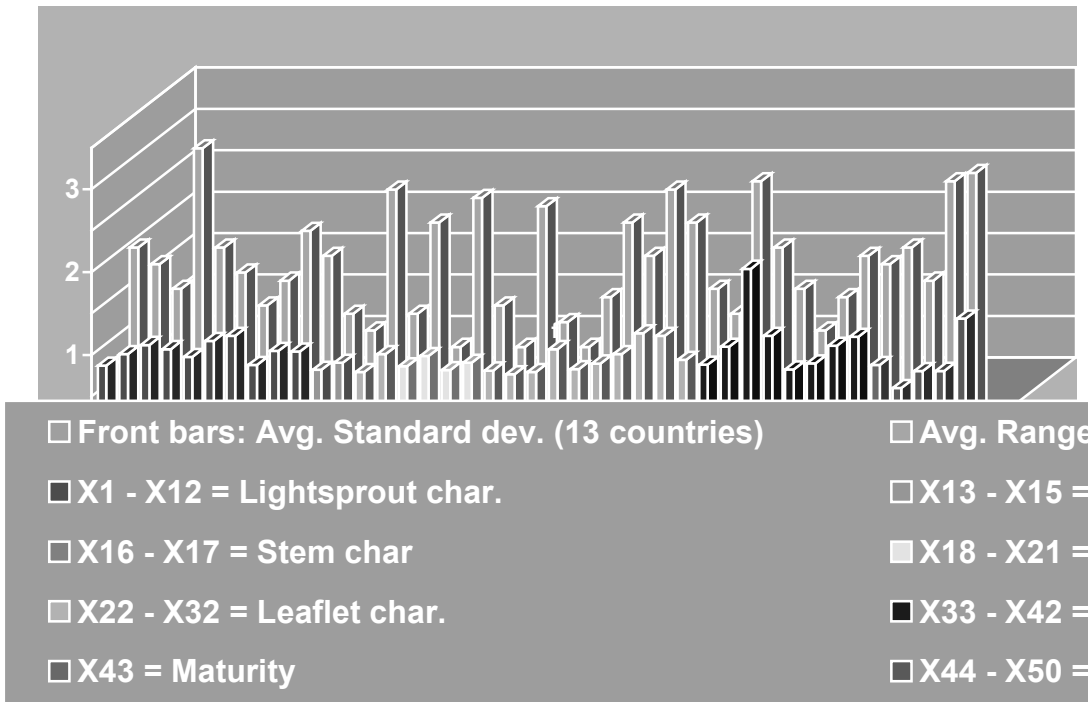
Front bars: Avg. Standard dev. (13   Avg. Range of char. (max-min across
countries)   countries)
X1-X12   = Lightsprout char.   X13-X15 = Plant char.
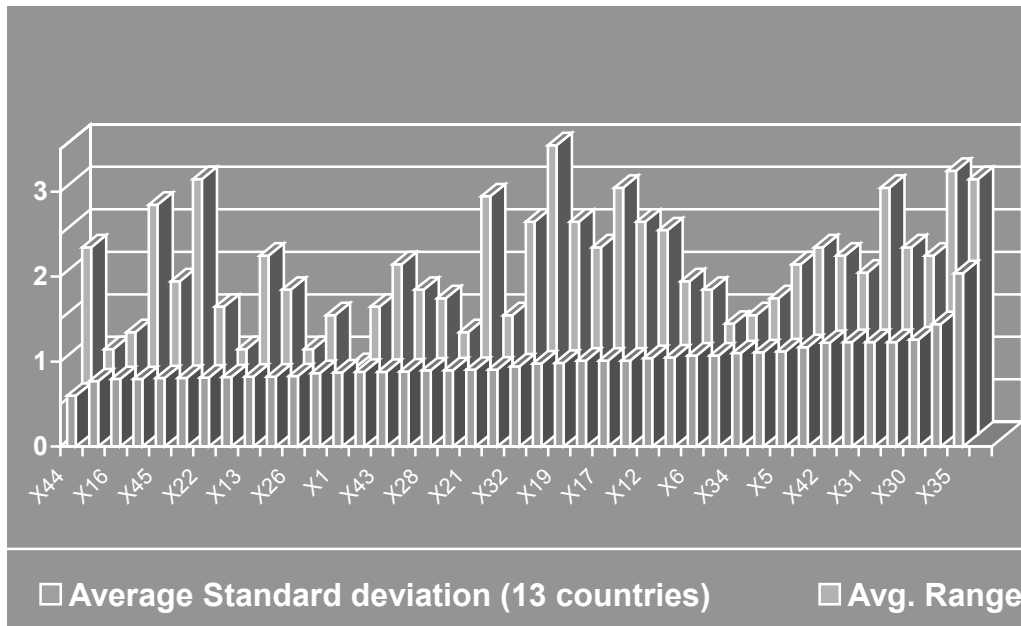X16-X17   = Stem char.   X18-X21 = Leaf char.
X22 – X32 = Leaflet char.   X33-X42 = Inflorescence char.
X43   = Maturity   X44-X50 = Tuber char.

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Front bars (green):   average standard deviation (13 countries)

Back bars (turquoise): average range of char. (max. min. across countries)

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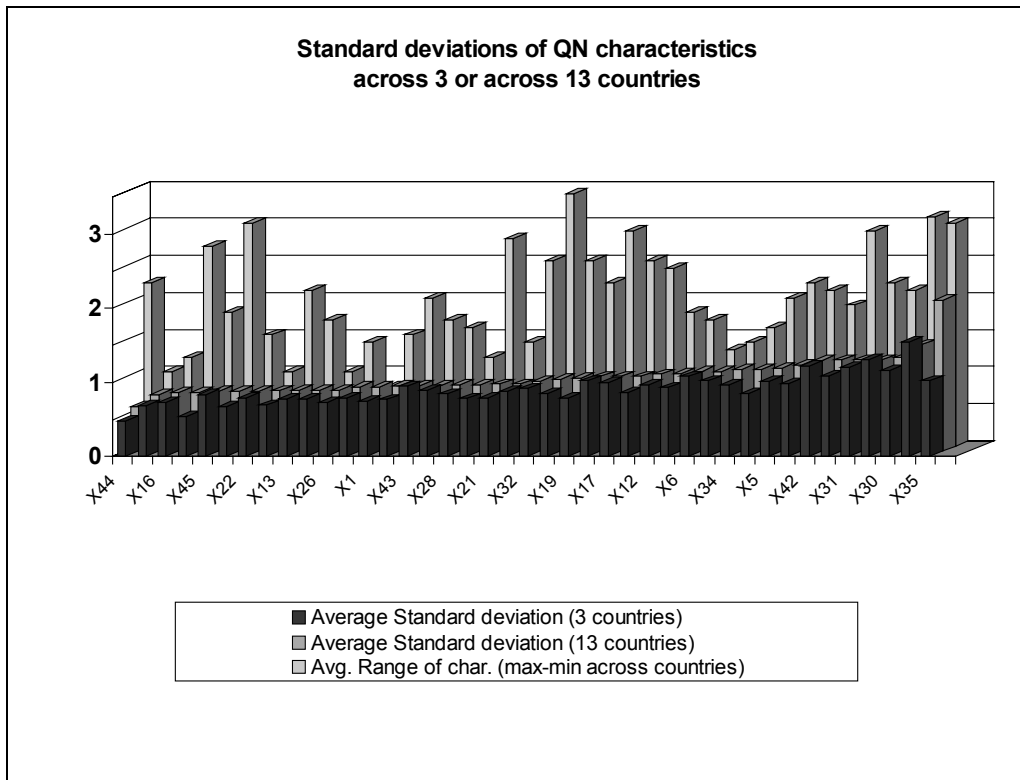
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Similarities among environments

- Correspondence analysis (multivariate - biplot):

  - similarities among countries for different sets of char.
  - pca for differences among (groups of) countries:
    - group of 3 North West European countries (NL-DE-CZ)
    - group of 5 North West European countries (NL-DE-CZ-SL-PO)
    - All countries (NW-EU, Commonwealth and Israel).
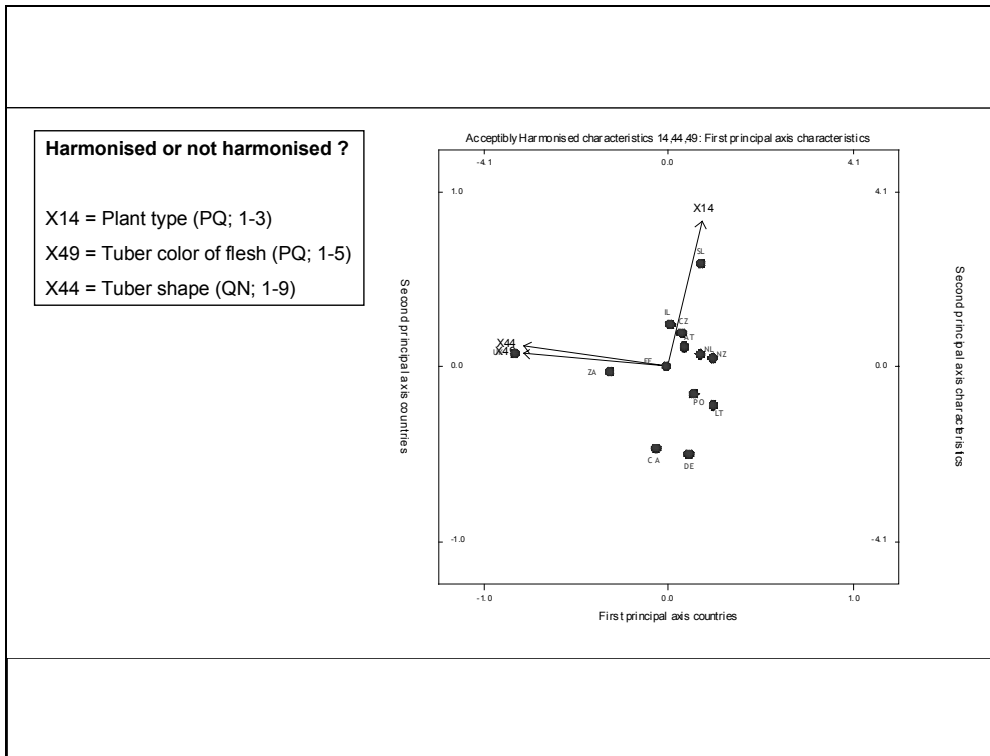 - multidimensional projection of correlations among characteristics on corresponding axes.
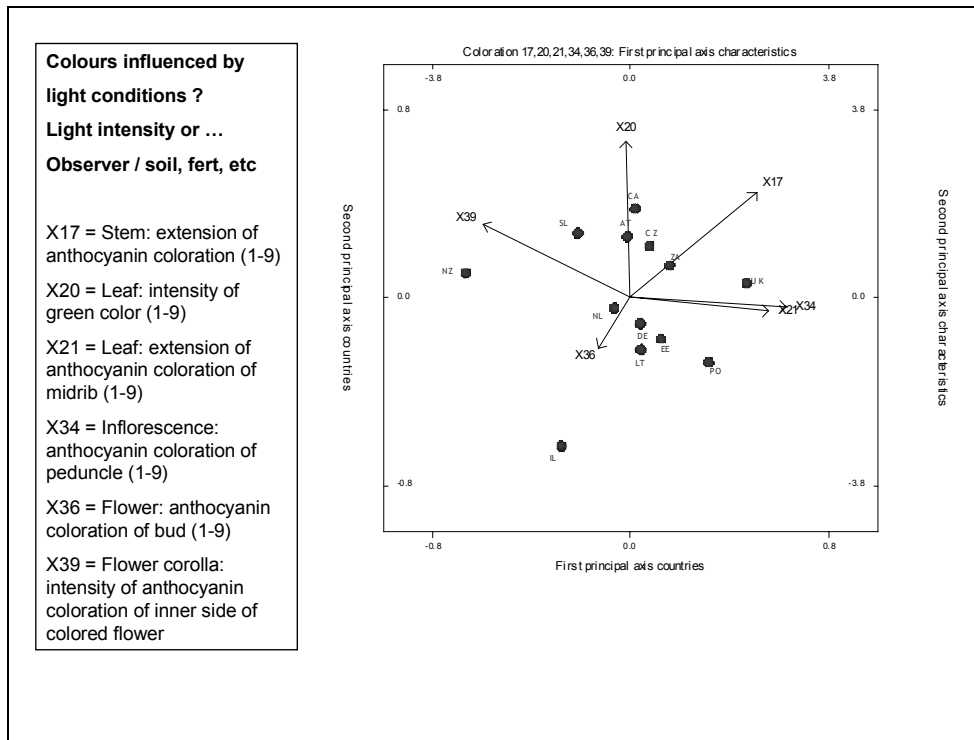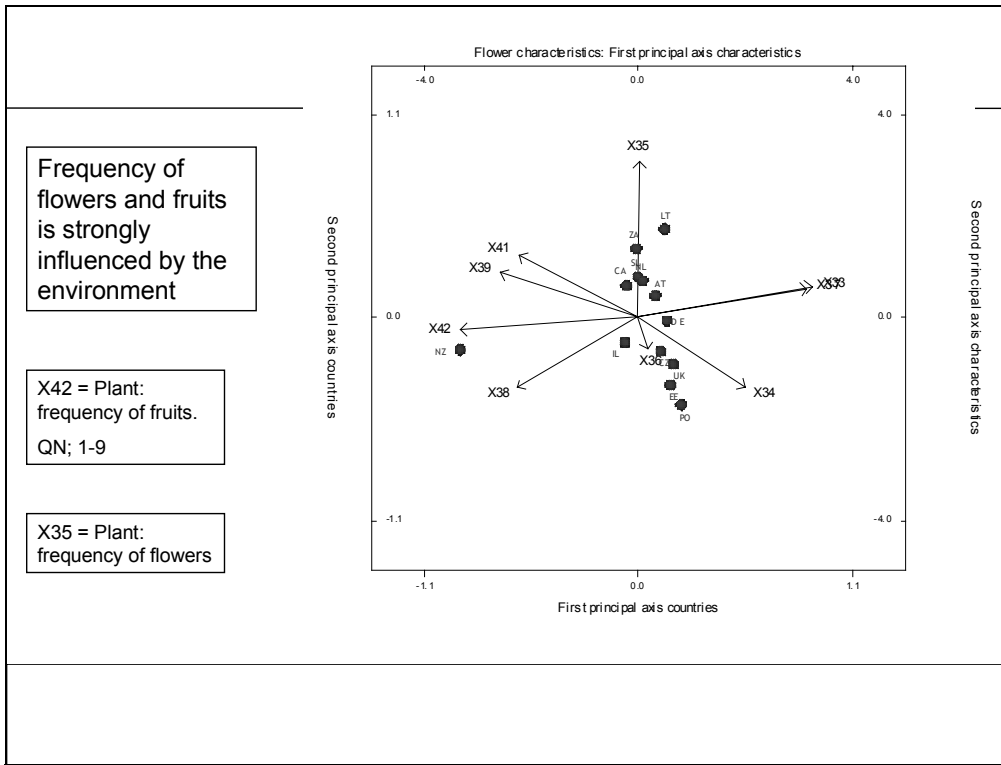
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Total dataset

Countries cluster in the centre.

IL, NZ main outliers.

CA, ZA, UK deviating for some characteristics

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3 countries: 100 % expl.

5 countries: 57.2 % expl.

10 countries: 33.5 % expl.

13 countries: 32.4 % expl.
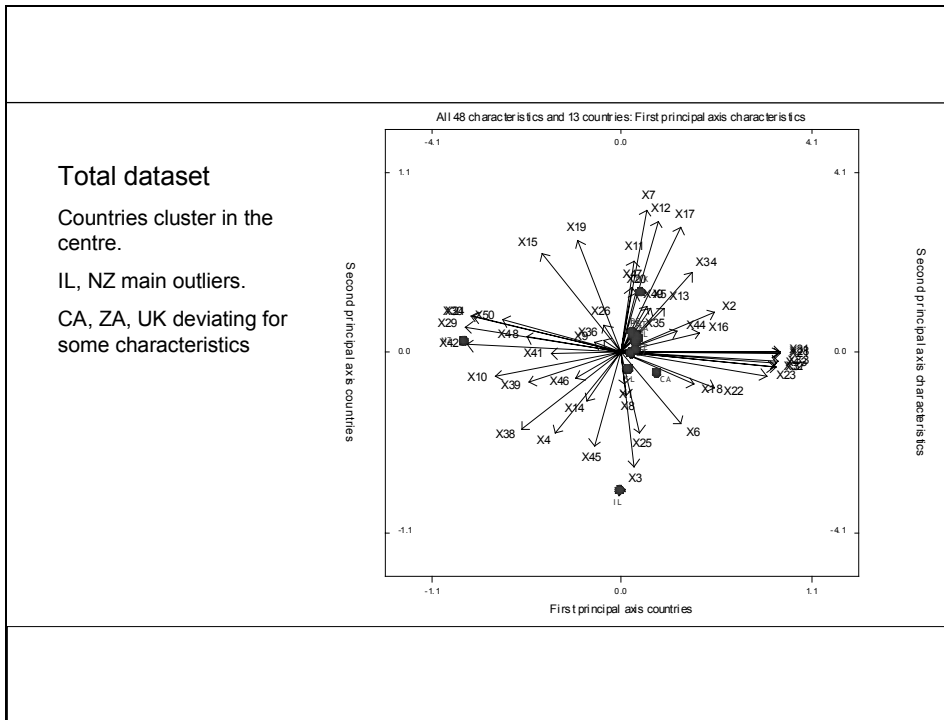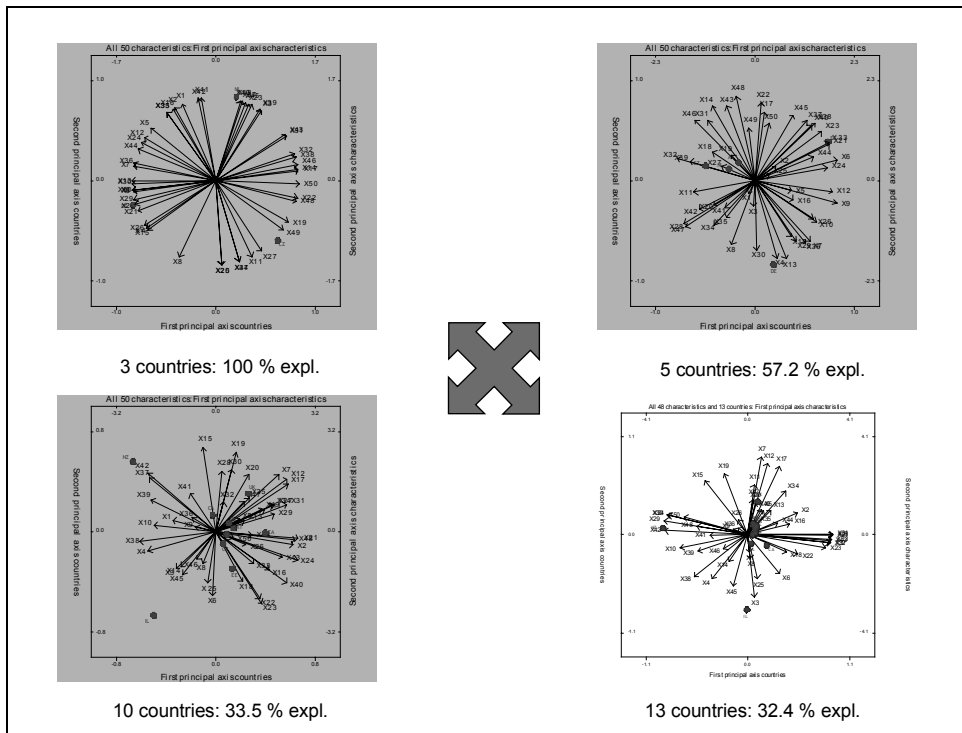
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Slide 32

Frequency of flowers and fruits is strongly influenced by the environment

X42 = Plant: frequency of fruits.
QN; 1-9

X35 = Plant: frequency of flowers

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X3 = Lightsprout: anthocyanin coloration of base.
QL * - g ; 1-2

X38 = Flower corolla: color of inner side.
PQ * - g ; 1-3

X47 = Tuber: color of skin.
PQ * - g ; 1-5

X48 = Tuber: color of base of eye.
PQ ; 1-3
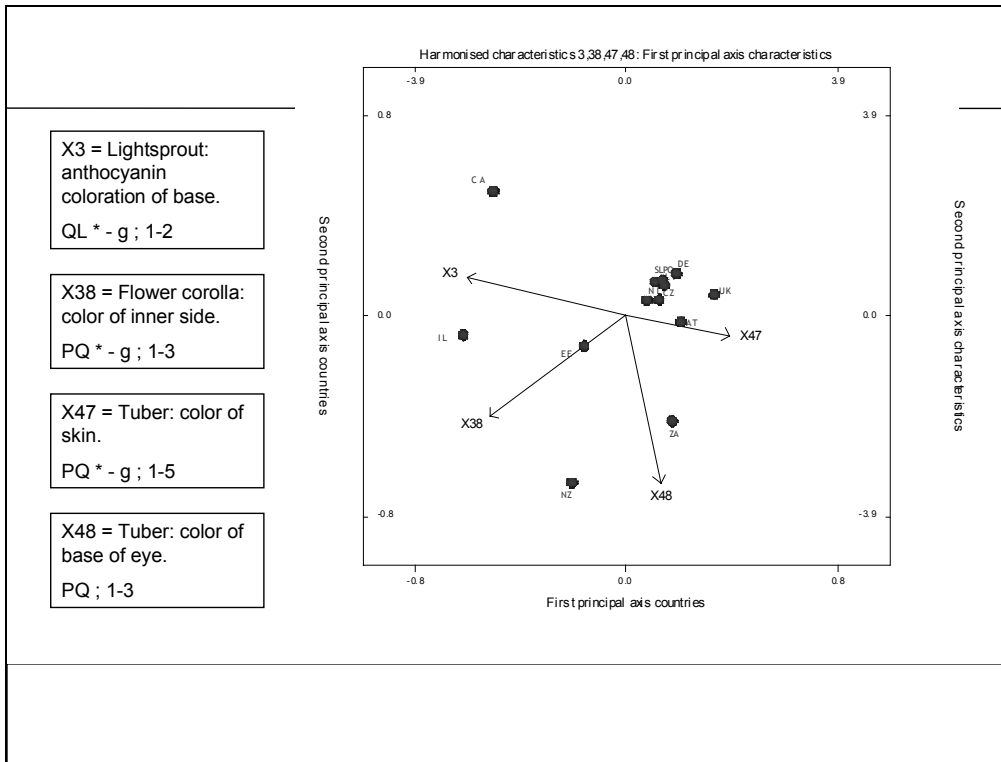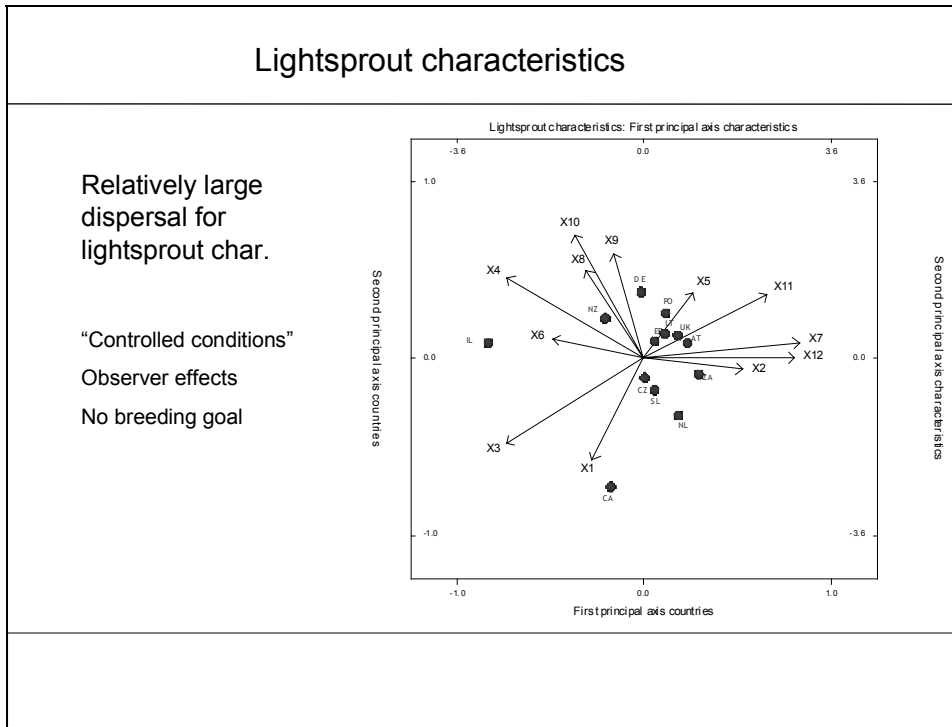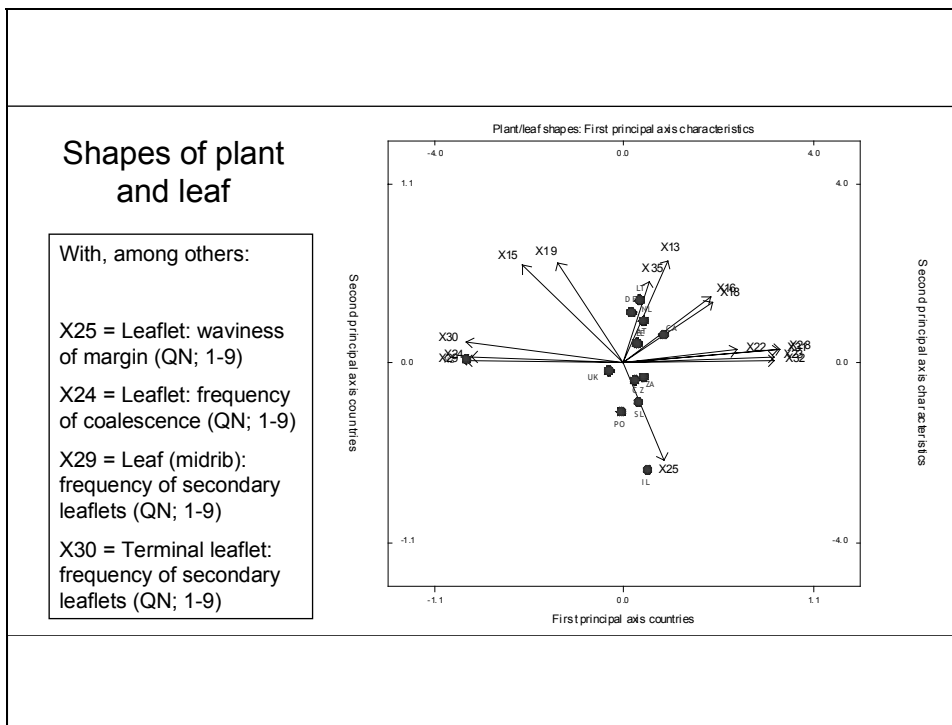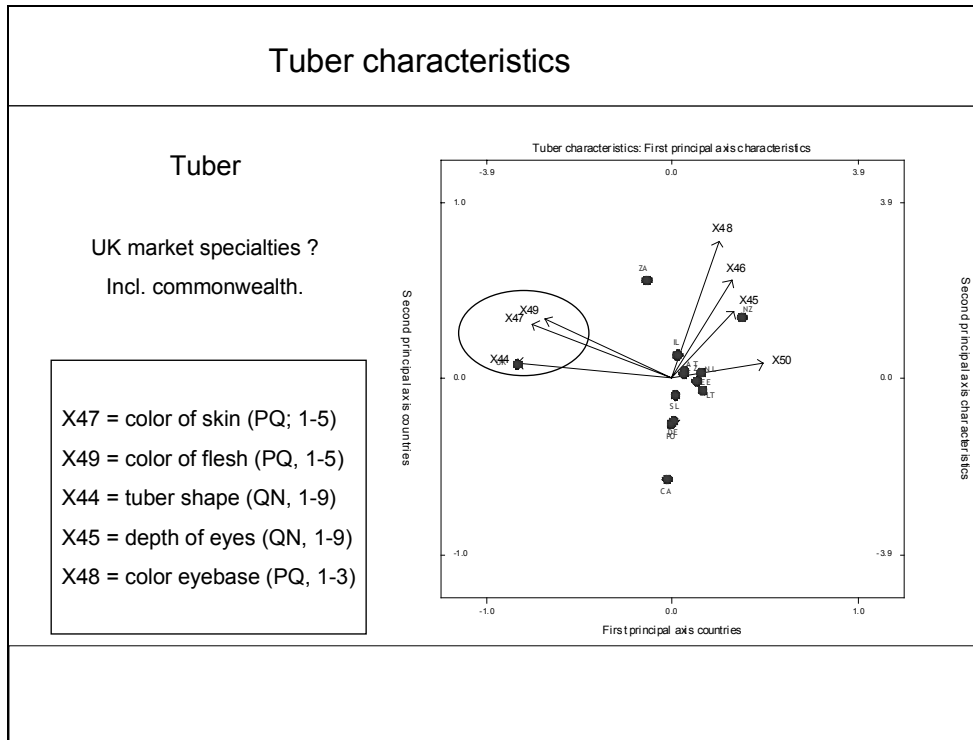
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Conclusions

- Characteristics
  - Some PQ and QL-characteristics are stable (skin and flower colour)
  - Most QN's are not stable across environments (in general)
  - Some QN-characteristics are more stable than others
  - Asterisked characteristics are not more stable than non-asterisked char.

- Regional similarities
  - Stability of char. across environments seems to increase in regional subsets
  - Further regional calibration is needed (especially on QN-characteristics)
  - Calibration can be achieved by use of ringtests and example varieties.

- Publication of Variety Descriptions ?
  - Descriptions should only be published when at least 3 descriptions per variety are available.
  - Mistakes and obvious deviations should be checked and (if necessary) corrected.
  - Descriptions can be based on stable (QL and PQ) characteristics.
  - Most QN-characteristics are not stable – they require special thresholds for distinctness.

[End of Annex and of document]