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POSSIBLE EFFECT ON UNIFORMITY DECISIONS BETWEEN APPROACH 3 AND OTHER APPROACHES IN DOCUMENT TWP/1/17 "ASSESSING UNIFORMITY BY OFF-TYPES ON THE BASIS OF MORE THAN ONE GROWING CYCLE OR ON THE BASIS OF SUB-SAMPLES"

Document prepared by the Office of the Union

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EXECUTIVE SUMMARY

1. The purpose of this document is to provide examples comparing the possible effect on uniformity decisions between Approach 3 and the other approaches presented in document TWP/1/17 "Assessing Uniformity by Off-Types on the Basis of More than One Growing Cycle or on the Basis of Sub-Samples", to be presented to the TWA, at its forty-sixth session.

2. The TWA is invited to consider the examples comparing the possible effect on uniformity decisions between Approach 3 and other approaches as presented in the Annexes to this document.

BACKGROUND

3. The background to this document is provided in document TWP/1/17 "Assessing Uniformity by Off-Types on the Basis of More than One Growing Cycle or on the Basis of Sub-Samples".

EXAMPLES COMPARING POSSIBLE EFFECTS ON UNIFORMITY DECISIONS

4. The Annexes to this document contain the following presentations to be made at the forty-sixth session of the Technical Working Party for Agricultural Crops (TWA).

ANNEX I "Effect of different approaches for the assessment of uniformity by off-types – examples for Barley", prepared by an expert from Germany;

ANNEX II "Assessing uniformity by off-types on the basis of more than one growing cycle in wheat" prepared by an expert from Poland

ANNEX III "The United Kingdom's Experience with Winter Oilseed Rape (WOSR)" prepared by an expert from the United Kingdom;

5. The TWA is invited to consider the examples comparing the possible effect on uniformity decisions between Approach 3 and other approaches as presented in the Annexes to this document.

[Annexes follow]

ANNEX I

EFFECT OF DIFFERENT APPROACHES FOR THE ASSESSMENT OF UNIFORMITY BY OFF-TYPES – EXAMPLES FOR BARLEY

Document prepared by an expert from Germany

1. The TWC was invited to develop guidance for the assessment of uniformity by off-types for inclusion in document TGP/10 “Examining uniformity”. Different approaches for decisions based on more than one growing cycle were developed. The TWA has considered these proposals and agreed that the guidance should provide parameters for decisions on the most suitable approach based on experience from members (see documents TWA/45/13 “Assessing Uniformity by Off-Types on the basis of more than one Growing Cycle or on the basis of Sub-Samples” and TWA/45/25 “Report”). The TWA agreed to provide examples comparing the possible effect on uniformity decisions between different approaches.

2. The following table summarizes practical examples from the DUS test for winter barley in 2014 and 2015. The growing trials comprise for each variety a sample size of 1000 plants in the first cycle and 2000 plants in the second. In the relevant year, 11 varieties were observed with different decisions based on the different approaches.

3. The following standards were applied:

Population standard: 0.1 %
Acceptance probability: ≥ 95%

Maximum number of allowed off-types:
3 in 1000 in the first cycle
5 in 2000 in the second cycle
6 in 3000 in the combined sample

Examples:

	Cycle 1		Cycle 2				
Sample size	1000	Pass(+) / Fail(-) test	2000	Pass(+) / Fail(-) test	Approach 1[1]	Approach 2[1]	Approach 3[1]
Max. off-types	3		5				
Variety 1	**3**	**+**	**7**	**-**	**third cycle**	**non-uniform**	**non-uniform**
Variety 2	5	-	3	+	third cycle	non-uniform	non-uniform
Variety 3	8	-	5	+	third cycle	non-uniform	non-uniform
Variety 4	**3**	**+**	**8**	**-**	**third cycle**	**non-uniform**	**non-uniform**
Variety 5	5	-	2	+	third cycle	non-uniform	non-uniform
Variety 6	5	-	0	+	third cycle	uniform	uniform
Variety 7	6	-	5	+	third cycle	non-uniform	non-uniform
Variety 8	8	-	2	+	third cycle	non-uniform	non-uniform
Variety 9	4	-	1	+	third cycle	uniform	uniform
Variety 10	5	-	1	+	third cycle	uniform	uniform
Variety 11	**3**	**+**	**5**	**+**	**uniform**	**uniform**	**non-uniform**

4. Approach 1 is applied in the German DUS system for all crops. When Approaches 2 or 3 are applied for this study it has to be taken into account that a re-submission is possible for the second cycle under specific conditions in barley. A new sample may be submitted for the second cycle if the first sample did not exceed a population standard of 0.5 % with an acceptance probability of ≥ 95% (9 in 1000). In general breeders use this possibility if the 0.1 % population standard is exceeded in the first cycle. Only Varieties 1, 4 and 7 were tested on the same sample in the two cycles.

[1] For the description of Approaches 1, 2 and 3 see document TWP/1/17 “Assessing Uniformity by Off-Types on the Basis of More than One Growing Cycle or on the Basis of Sub-Samples”

5. More off-types were observed in the first cycle in most examples. This can be attributed to the following reasons:

- The new sample for the second cycle was improved.

- The expression of anthocyanin coloration and glaucosity was stronger in cycle 1 of the concerned testing period due to environmental effects. Stronger expression can be linked to higher discrimination between varieties and higher sensitivity to detect off-types within varieties.

6. Approaches 2 and 3 should only be applied if the same sample was tested in both cycles. This condition is only fulfilled for Varieties 1, 4 and 11. One variety (out of those three) would be accepted after two cycles with Approaches 1 and 2 (Variety 11). All varieties would be rejected with approach 3 (Varieties 1, 4 and 11). Two varieties need a third cycle with approach 1 (Varieties 1 and 4).

7. If it is ignored for the purpose of this study that Approaches 2 and 3 should not be applied in the case of different samples, the examples confirm that Approach 3 is the most stringent one. Variety 11 would be rejected with Approach 3 even if it was within the uniformity standard in both individual cycles. The example of Variety 11 represents the only difference between Approaches 2 and 3.

8. The disadvantage of Approach 1 is a possible prolongation of the test, but a third cycle allows for a better consideration of environmental effects. For example, in Variety 1 the following off-types were observed (same seed sample):

Cycle 1, 3 off-types in 1000:	1 x stronger anthocyanin coloration of auricles, 1 x earlier heading, 1 x full sterile spikelet
Cycle 2, 7 off-types in 2000:	2 x stronger anthocyanin coloration of auricles, 5 x stronger ear glaucosity
Cycle 3, 2 off-types in 2000:	2 x stronger anthocyanin coloration of auricles

9. Finally, the variety was within tolerance in 2 out of 3 cycles and considered to be uniform. Off-types in ear glaucosity have only been observed in the second cycle. Environmental effect cannot be excluded.

10. The following off-types were observed for Variety 4:

Cycle 1, 3 off-types in 1000:	1 x stronger anthocyanin coloration of auricles, 1 x earlier heading, 1 x attitude sterile spikelet
Cycle 2, 8 off-types in 2000:	4 x stronger anthocyanin coloration of auricles, 1 x earlier heading, 2 x weaker ear glaucosity 1 x without sterile spikelet

11. The variety was withdrawn after the second cycle.

12. Only Approach 1 is appropriate for the German DUS system in barley because a re-submission is possible for the second cycle. Approach 1 is also preferred because of a better consideration of possible environmental effects on the expression of some characteristics. Approaches 2 and 3 would not allow for a change of the seed sample. In addition, more stringent decisions are taken with Approaches 2 and 3.

[Annex II follows]

ANNEX II

ASSESSING UNIFORMITY BY OFF-TYPES ON THE BASIS OF MORE THAN ONE GROWING CYCLE IN WHEAT

Presentation prepared by an expert from Poland

TWA_46th session
Hannover, 19-23.06.2017

Assessing uniformity by off-types on the basis of more than one growing cycle in wheat

Karolina Lenartowicz

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TWA_46th session
Hannover, 19-23.06.2017

Example – Wheat hybrid varieties

Population standard 10%
Acceptance Probability ≥ 95%

Sample size for each approach and growing cycle

Approach	Growing cycle 1 n1	Growing cycle 2 n2	Growing cycle 3 n3	Combined n1+n2
1	200	200	200	n/a
2	200	200	0	400
3	200	200	0	400

Maximum number of off-types for each approach and growing cycle/stage

Approach	Growing cycle 1 n1	Growing cycle 2 n2	Growing cycle 3 n3	Combined n1+n2
1	27	27	27	n/a
2	27	27	n/a	50
3	50	n/a	n/a	50

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Example: Wheat hybrid varieties						
	Population standard = 10%					
	Acceptance probability ≥ 95%					
	Sample size in each of growing cycles 1 and 2 = 200					
	Maximum number off-types = 27					
	Sample size in growing cycles 1 and 2 (combined) = 400					
	Maximum number off-types = 50					
	Growing cycle		**Decision**			
	First	**Second**	**Approach 1**	**Approach 2**	**Approach 3**	
Number of off-types	10	5	uniform	uniform	uniform	← consistent
	27	27	uniform	uniform	non-uniform	← inconsistent
	0	28*	third growing cycle*	uniform*	uniform*	
	5	28*	third growing cycle*	non-uniform*	non-uniform*	
	10	51*	third growing cycle*	non-uniform*	non-uniform*	
	51	10*	third growing cycle*	non-uniform*	non-uniform	

*Care is needed when considering results that were very different in each of the growing cycles, such as when a type of off-types was observed at a high level in one growing cycle and was absent in another growing cycle.

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Example – Wheat population varieties

Population standard = 0,3%
Acceptance Probability ≥ 95%

Sample size for each approach and growing cycle

Approach	Growing cycle 1 n1	Growing cycle 2 n2	Growing cycle 3 n3	Combined n1+n2
1	3200	3200	3200	n/a
2	3200	3200	n/a	6400
3	3200	3200	n/a	6400

Maximum number of off-types for each approach and growing cycle/stage

Approach	Growing cycle 1 n1	Growing cycle 2 n2	Growing cycle 3 n3	Combined n1+n2
1	15	15	15	n/a
2	15	15	n/a	27
3	27	n/a	n/a	27

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Example: Wheat population varieties						
	Population standard = 0,3%					
	Acceptance probability ≥ 95%					
	Sample size in each of growing cycles 1 and 2 = 3200					
	Maximum number off-types = 15					
	Sample size in growing cycles 1 and 2 (combined) = 6400					
	Maximum number off-types = 27					
	Growing cycle		Decision			
	First	Second	Approach 1	Approach 2	Approach 3	
Number of off-types	1	14	uniform	uniform	uniform	← consistent
	15	15	uniform	uniform	non-uniform	← inconsistent
	0	25*	third growing cycle*	uniform*	uniform*	
	5	28*	third growing cycle*	non-uniform*	non-uniform*	
	5	30*	third growing cycle*	non-uniform*	non-uniform*	
	30	5*	third growing cycle*	non-uniform*	non-uniform	

*Care is needed when considering results that were very different in each of the growing cycles, such as when a type of off-types was observed at a high level in one growing cycle and was absent in another growing cycle.

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Conclusions/Questions

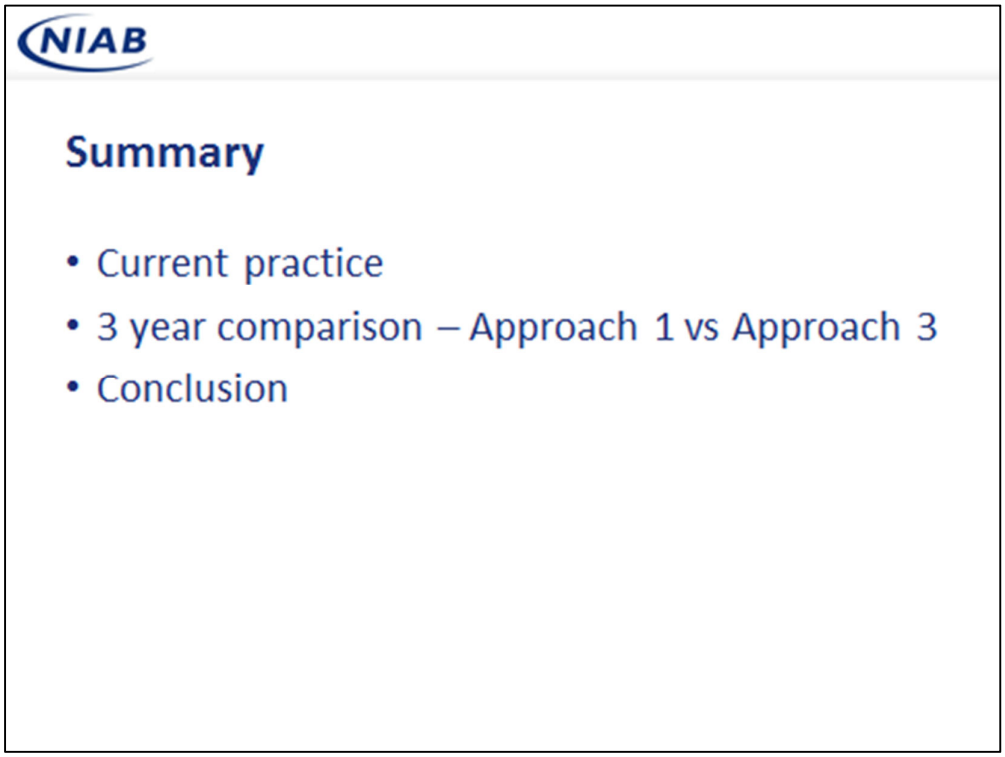
- different approaches may give different uniformity decisions for the same variety sample tested
- should the approach be pre-defined at the beginning of testing?
- is it possible/allowed to change the approach in the course of variety testing?
- what criteria should be used to choose the approach?

[Annex III follows]

ANNEX III

THE UNITED KINGDOM'S EXPERIENCE WITH WINTER OILSEED RAPE (WOSR)

Presentation by an expert from the United Kingdom



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Current Practice: Approach 3 – combining the results of two growing cycles

However:

- Collaborative approach - breeders informed and invited to view any issues throughout testing period
- Indication of number of off-types and the approximate threshold given at end of Year 1 and Breeder decides whether to proceed to year 2
- Option for a third year of test available – either as Test Centre recommendation or at Breeder request

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Standards

- Hybrids – 10% at 95% acceptance probability
- Lines – 2% at 95% acceptance probability
- Number of plants observed – minimum according to TG is 200; on average 400 per cycle examined across minimum of 2 replicates

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Summary 2015-16

286 candidates - Year 1 and Year 2

Year 1

- 174 Candidates in test
  - 68 Hybrids / 107 Conventional varieties /parental lines

Year 2

- 112 Candidates in Test
  - 44 Hybrids / 68 Conventional varieties/parental lines

Uniformity issues

- Fail year 1 - none
- Fail Year 2 - none
- Fail combined - none

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Summary 2014-2015

309 Candidates - Year 1 and Year 2

Year 1

- 199 Candidates in test
  - 77 Hybrids / 122 Conventional varieties /parental lines

Year 2

- 112 Candidates in Test
  - 44 Hybrids / 66 Conventional varieties/parental lines

Uniformity issues

- Fail year 1 : one Line 15 observed off- types (threshold = 11) Withdrawn.
- Fail Year 2 - none
- Fail combined - none

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Summary 2013-14

297 candidates in Test - Year 1 and Year 2

Year 1

- 163 candidates in test
  - 66 Hybrids/ 97 Conventional and Parent Lines

Year 2

- 134 candidates in test
  - 49 Hybrids / 85 Conventional and Parents

Uniformity Issues

- see Table on next slide

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Uniformity Issues 2013-14

Type	2013 offtypes	2013 threshold		2014 offtypes	2014 threshold		combined 2013+2014 offtypes	combined threshold 2013+2014	Comments
LINE 1	9	8							Withdrawn at end year 1
LINE 2	1	6		9	8		10	12	Pass under Approach 3 . Fail year 2 under Approach 1 and proceed to 3rd year
LINE 3	11	8		7	7		18	13	Fail under Approach 3. Option for 3rd year available. Fail Year 1 under Approach 1 and proceed to 3rd year. However PL of hybrid and was re-submitted for 2 further years of test – at breeder request - and passed.
LINE 4	3	7		13	8		16	13	Fail under Approach 3. Option for 3rd year available. Fail Year 2 under Approach 1 and proceed to 3rd Year.
LINE 5	6	7		7	8		13	13	Approach 1 - consistent Year 1 & Year 2 - just within threshold. Approach 3 on the threshold . Would pass under either Approach.

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Conclusions:

- Data from three trial years assessed
- 892 uniformity decisions
- Only 3 decisions may have been different
  - 2 failures under Approach 3 would have resulted in 3rd Year under approach 1. (Year 3 still an option under Approach 3)
  - 1 pass under Approach 3 would have resulted in a 3rd Year under Approach 1
- The United Kingdom are confident with its use of Approach 3 for Winter Oilseed Rape (WOSR)

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Any questions?

[End of Annex III and of document]