UPOV

International Union for the Protection of New Varieties of Plants

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Technical Working Party for Agricultural Crops
Forty-Sixth Session
Hanover, Germany, June 19 to 23, 2017

Technical Working Party for Vegetables
Fifty-First Session
Roelofarendsveen, Netherlands, July 3 to 7, 2017

Technical Working Party for Ornamental Plants and Forest Trees
Fiftieth Session
Victoria, Canada, September 11 to 15, 2017

Technical Working Party for Fruit Crops
Forty-Eighth Session
Kelowna, Canada, September 18 to 22, 2017

Technical Working Party on Automation and Computer Programs
Thirty-Fifth Session
Buenos Aires, Argentina, November 14 to 17, 2017

TWP/1/7

Original: English
Date: June 9, 2017

MOLECULAR TECHNIQUES

Document prepared by the Office of the Union

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EXECUTIVE SUMMARY

1. The purpose of this document is to report developments concerning molecular techniques in relation to the Technical Working Parties and the OECD/UPOV/ISTA Joint Workshop on Molecular Techniques, and on a question and answer concerning the information on the situation in UPOV with regard to the use of molecular techniques for a wider audience, including the public in general.

2. The TWPs are invited to note:

(a) the report on developments in the TWPs and BMT, as set out in paragraphs 5 to 24 of this document;

(b) that a Joint OECD/UPOV/ISTA/AOSA Workshop on Biochemical and Molecular Methods had been held in Paris on June 8, 2016, and that the recommendations of the Joint OECD/UPOV/ISTA/AOSA Workshop as reproduced in paragraph 25 of this document, were approved by the Annual Meeting of the OECD Seed Schemes, held in Paris on June 9 and 10, 2016;

(c) that a question and answer concerning the information on the situation in UPOV with regard to the use of molecular techniques for a wider audience, including the public in general, as set out in paragraph 29, was adopted by the Council, at its fiftieth session;

(d) that the TC, at its fifty-third session, agreed that possible future collaboration between UPOV, OECD and ISTA might include the harmonization of terms and methodologies used for different crops and the possible development of standards, after agreement by those organizations;

(e) that a first practical workshop “DNA Techniques and Variety Identification” was held in Roelofarendsveen, Netherlands, from May 8 to 10, 2017 and that a second practical workshop is planned for September 2017;

(f) that the TC agreed that UPOV and OECD should consider making progress in the matters above if ISTA was unable to participate in the near future; and

(g) that the TC agreed to propose that the meetings of the BMT be held on an annual basis and that consideration be given to organizing the sessions of the TWC and BMT back-to-back in the same location to facilitate exchange of information.

3. The following abbreviations are used in this document:

BMT: Working Group on Biochemical and Molecular Techniques, and DNA-Profiling in Particular
CAJ: Administrative and Legal Committee
TC: Technical Committee
TWA: Technical Working Party for Agricultural Crops
TWC: Technical Working Party on Automation and Computer Programs
TWF: Technical Working Party for Fruit Crops
TWO: Technical Working Party for Ornamental Plants and Forest Trees
TWPs: Technical Working Parties
TWV: Technical Working Party for Vegetables
OECD: Organization for Economic Co-operation and Development
AOSA: Association of Official Seed Analysts
ISTA: International Seed Testing Association

4. The structure of this document is as follows:

DEVELOPMENTS AT THE TECHNICAL WORKING PARTIES IN 2016

5. At their sessions in 2016, the TWC, TWO, TWV, TWA and TWF considered documents TWC/34/2, TWO/49/2, TWV/50/2, TWA/25/2 and TWF/47/2 “Molecular Techniques”, respectively.

6. The TWC, at its thirty-forth session, held in Shanghai, China, from June 7 to June 10, 2016, received an oral report from Mr. Kees van Ettekoven (Netherlands), Chairperson of the BMT (see document TWC/34/32 “Report”, paragraph 7).

7. The TWC welcomed the offer by the Netherlands to report on projects on the use of molecular techniques in DUS examination to the TWC, at its thirty-fifth session (see documents BMT/15/21 “Efficient DUS test in French bean by using molecular data” and BMT/15/22 “Can molecular distance be used as a characteristic?”) (see document TWC/34/32 “Report”, paragraph 11).

8. The TWC welcomed the offer by China to report its experience on the use of DNA databases of maize, rice and wheat when selecting similar varieties for the examination of distinctness (see document TWC/34/32 “Report”, paragraph 12).

9. The TWC agreed to invite presentations from members on the statistical aspects of using molecular markers in DUS examination, including the selection of similar varieties and organization of growing trials. The TWC welcomed the offer by France to make a presentation on current work with databases that include molecular information with computation of molecular distances using the GAIA software (see document TWC/34/32 "Report", paragraph 13).

10. The TWC agreed that software and databases as well as associated statistical methods were important elements of DUS examination and of increasing relevance to plant variety protection. The TWC agreed that the Chairperson of the TWC should report on these particular elements of the work of the TWC to the Technical Committee (see document TWC/34/32 "Report", paragraph 14).

DEVELOPMENTS IN THE TC IN 2016

11. The TC, at its fifty-second session, held in Geneva, from March 14 to 16, 2016, noted that the fifteenth session of the BMT agenda item 5 "Report of work on molecular techniques in relation to DUS examination" would provide an opportunity for UPOV members to report on latest developments concerning the use of molecular techniques in DUS examination, and that this could form the basis to propose new application models for inclusion in document TGP/15 "Guidance on the Use of Biochemical and Molecular Markers in the Examination of Distinctness, Uniformity and Stability (DUS)" (see document TC/52/29 Rev. "Revised Report", paragraph 132).

DEVELOPMENTS AT THE FIFTEENTH SESSION OF THE WORKING GROUP ON BIOCHEMICAL AND MOLECULAR TECHNIQUES, AND DNA-PROFILING IN PARTICULAR

12. The role of the BMT is reproduced in the Annex to this document.

13. The fifteenth session of the BMT was held in Moscow, Russian Federation, from May 24 to 27, 2016, with the preparatory workshop on May 23, 2016. The specific day for the agenda items "Report of work on molecular techniques in relation to DUS examination" and "The use of molecular techniques in variety identification" (the "Breeders' Day") was May 25, 2016.

Papers presented at the fifteenth session of the BMT

14. The papers presented under each of the agenda items of the fifteenth session of the BMT were as follows:

Short presentations on new developments in biochemical and molecular techniques by DUS experts, biochemical and molecular specialists, plant breeders and relevant international organizations

CPVO Report to UPOV BMT (document BMT/15/27)

Report of work on molecular techniques in relation to DUS examination

Work on molecular techniques in relation to DUS examination of different fruit species (document BMT/15/11)

Molecular Marker use in the PVP Application Process - A Joint Project between the US PVP Office and the American Seed Trade Association Mapping (document BMT/15/12)

Evaluation of Soybean Molecular Marker Public Resources for Potential Application in Plant Breeders' Rights (document BMT/15/13)

Comparison of Genotypic and Expression Data to Determine Distinctness among Inbred Lines of Maize for Granting Plant Breeders' Rights (document BMT/15/14)

Efficient DUS test in French bean by using molecular data (document BMT/15/21)

Can molecular distance be used as characteristic? (document BMT/15/22)

International guidelines on molecular methodologies (document BMT/15/3 Rev.)

UPOV and ISO TC 34/SC 16 – From the US Technical Advisory Group and ANSI led host of ISO TC 34/SC 16: Food Products; horizontal methods for molecular biomarker analysis (document BMT/15/7)

DNA-based method for variety testing: ISTA approach (document BMT/15/19)

Methods for analysis of molecular data

Molecular Data analysis capacity (document BMT/15/10)

The use of molecular techniques in variety identification

Variety identification of barley using KASP genotypes (document BMT/15/6)

Fast Single-step Detection and Identification of Multiple Phytopathogens and GMO with real-time PCR-matrix Technique (document BMT/15/9)

New developments concerning biochemical and molecular techniques in Belarus (document BMT/15/15)

Gene and genome editing with CRISPR-cas9 (document BMT/15/17)

Using of DNA – marker based techniques for varietal identification and fingerprinting of fruit crops and grape genetic resources (document BMT/15/18)

Green Forensics: Whole Genome Sequencing approach for PBR enforcement (document BMT/15/23)

Application of DNA marker technologies in Vegetable Breeding (document BMT/15/24)

Laboratory seed control of barley (document BMT/15/25)

Assessment and classification of breeding accessions of vegetable plants with the use of DNA markers (document BMT/15/26)

Databases containing molecular data

Towards durable DNA databases to support DUS testing (document BMT/15/16)

Advances in the Construction and Application of DNA Fingerprint Databases in Maize (document BMT/15/20)

Cooperation between OECD, UPOV, ISTA and ISO

15. The TC, at its fifty-first session, agreed the following (see document TC/52/29 Rev. “Revised Report”, paragraph 129):

(a) to develop a joint document explaining the principal features of the systems of the OECD, UPOV and ISTA;

(b) to develop an inventory on the use of molecular marker techniques, by crop, with a view to developing a joint OECD/UPOV/ISTA document containing that information, in a similar format to UPOV document UPOV/INF/16 “Exchangeable Software”, subject to the approval of the Council and in coordination with OECD and ISTA; and

(c) the proposal for the BMT, at its fifteenth session, to develop lists of possible joint initiatives with OECD and ISTA in relation to molecular techniques for consideration by the TC to be presented at the TC, at its fifty-third session.

16. The TC agreed that the BMT should include the development of a list of terminology (definitions) used by OECD, UPOV and ISTA in the list of joint initiatives in relation to molecular techniques, for consideration by the TC, at its fifty-third session 2016 (see document TC/52/29 Rev. "Revised Report", paragraph 130).

17. The BMT, at its fifteenth session, received a presentation by the Office of the Union on cooperation between OECD, UPOV, ISTA and ISO, on the basis of document BMT/15/5 "Cooperation between OECD, UPOV, ISTA and ISO" (see document BMT/15/28 "Revised Report", paragraphs 38).

18. The BMT noted that the development of a joint document explaining the principal features of the systems of the OECD, UPOV and ISTA could only start after agreement by OECD and ISTA (see document BMT/15/28, paragraph 39).

19. The BMT noted that the development of a joint OECD/UPOV/ISTA document containing an inventory of molecular marker techniques used by crop could only start after agreement by OECD and ISTA (see document BMT/15/28, paragraphs 40).

20. The BMT noted that OECD, ISTA and UPOV had different objectives and cooperation between the organizations in the use of molecular techniques would need to reflect that. However, the BMT agreed that it would be important to explore circumstances in which the same techniques and information could be used. In the first instance, it agreed that it would be more effective to explore such possibilities on the basis of real situations rather than at a theoretical and institutional level (see document BMT/15/28, paragraphs 41).

21. The BMT welcomed the proposal by the Netherlands to organize a practical workshop in 2017, with support from UPOV, OECD and ISTA, to explore how molecular techniques might be applied in an efficient way for UPOV, OECD and ISTA purposes[1] (see document BMT/15/28, paragraphs 42).

22. The BMT agreed that possible future collaboration between UPOV, OECD and ISTA might include the harmonization of terms and methodologies used for different crops and the possible development of standards, after the agreement by these organizations (see document BMT/15/28, paragraphs 43).

Future Program

23. The BMT agreed to an invitation from France to hold its sixteenth session in France at the end of September or beginning of October 2017, with the preparatory workshop to be held the day before the BMT session. The BMT planned to discuss the following items (see document BMT/15/28, paragraph 48):

1. Opening of the session

2. Adoption of the agenda

3. Reports on developments in UPOV concerning biochemical and molecular techniques (document to be prepared by the Office of the Union)

4. Short presentations on new developments in biochemical and molecular techniques by DUS experts, biochemical and molecular specialists, plant breeders and relevant international organizations (oral reports by participants)

5. Report of work on molecular techniques in relation to DUS examination (papers invited)

6. International guidelines on molecular methodologies including cooperation between OECD, UPOV, ISTA and ISO (document to be prepared by the Office of the Union)

7. Variety description databases including databases containing molecular data (papers invited)

8. Methods for analysis of molecular data (papers invited)

[1] In relation to the offer of the Netherlands to organize a practical workshop in 2017, with support from UPOV, OECD and ISTA, to explore how molecular techniques might be applied in an efficient way for UPOV, OECD and ISTA purposes (see paragraph 15 of this document), the Office of the Union transmitted information concerning a workshop "DNA Techniques and Variety Identification", being organized by Naktuinbouw, in Roelofarendsveen, Netherlands, from May 8 to 10, 2017, (see UPOV Circular E-17/015, of January 23, 2017).

9. The use of molecular techniques in examining essential derivation (papers invited)[2]

10. The use of molecular techniques in variety identification (papers invited)[2]

11. Review of document UPOV/INF/17 "Guidelines for DNA-Profiling: Molecular Marker Selection and Database Construction ('BMT Guidelines')"

12. Date and place of next session

13. Future program

14. Report of the session (if time permits)

15. Closing of the session

24. On October 31, the Office of the Union received a proposal from France to hold the sixteenth session of the BMT, in La Rochelle, France, from November 7 to 10, 2017, with the preparatory meeting to be held on November 6, 2017.

OECD/UPOV/ISTA JOINT WORKSHOP ON MOLECULAR TECHNIQUES

25. A Joint OECD/UPOV/ISTA/AOSA Workshop on Biochemical and Molecular Methods was held in Paris, France, on June 8, 2016, and the following recommendations of the Joint OECD/UPOV/ISTA/AOSA Workshop were approved by the Annual Meeting of the OECD Seed Schemes, held in Paris, France, on June 9 and 10, 2016:

(a) To develop a joint document explaining the principal features (e.g. DUS, variety identification, variety purity, etc.) of the systems of OECD, UPOV, AOSA and ISTA and, for mutual understanding, to repeat the joint workshop at relevant meetings of the OECD and ISTA;

(b) To carry out a joint inventory by UPOV, OECD, AOSA and ISTA of the use of molecular marker techniques, by crop, with a view to developing a document containing that information. The OECD will contribute to the document by sharing the ongoing list of molecular techniques used by National Designated Authorities (NDAs) and continuously collected by the Secretariat;

(c) To develop a list of terms and their definitions as used by OECD, UPOV, AOSA and ISTA and to make an attempt to harmonize these;

(d) To consider organizing another similar workshop in three years' time; and

(e) To consider replacing the term used in the OECD Seed Schemes for the status of DNA based techniques from "internationally validated" to another term such as "internationally harmonized."

26. The Annual Meeting of the OECD Seed Schemes endorsed the proposal of the Netherlands to organize a practical workshop in 2017, with support of the OECD, UPOV and ISTA, to explore how molecular techniques might be applied in an efficient way for UPOV, OECD and ISTA purposes.

PRESENTATION OF INFORMATION ON THE SITUATION IN UPOV WITH REGARD TO THE USE OF MOLECULAR TECHNIQUES

27. The TC, at its fifty-second session, agreed a draft question and answer concerning the information on the situation in UPOV with regard to the use of molecular techniques for a wider audience, including the public in general (see document TC/52/29 Rev. "Revised Report", paragraph 131). The draft was adopted by the Council, at its fiftieth session, held in Geneva, on October 28, 2016, with no amendments, as reproduced in paragraph 29 of this document.

[2] Breeder's Day

28. The CAJ, at its seventy-third session, held in Geneva, on October 25, agreed the draft question and answer concerning the information on the situation in UPOV with regard to the use of molecular techniques for a wider audience, including the public in general, as agreed by the TC, at its fifty-second session (see document CAJ/73/10 "Report on the Conclusions", paragraph 57).

29. The Council, at its fiftieth session, adopted the following FAQ concerning information on the situation in UPOV with regard to the use of molecular techniques for a wider audience ("FAQ on molecular techniques"), including the public in general (see document C/50/19 "Report on the Decisions", paragraph 11. FAQ available at: http://www.upov.int/about/en/faq.html#QG121):

> "Is it possible to obtain protection of a variety on the basis of its DNA-profile?
>
> "For a variety to be protected, it needs to be clearly distinguishable from all existing varieties on the basis of characteristics that are physically expressed, e.g. plant height, time of flowering, fruit color, disease resistance etc. The DNA-profile is not the basis for obtaining the protection of a variety, although this information may be used as supporting information.
>
> "A more detailed explanation is provided in the FAQ 'Does UPOV allow molecular techniques (DNA profiles) in the examination of Distinctness, Uniformity and Stability ("DUS")?'
>
> "See also:
> "What are the requirements for protecting a new plant variety?"

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DEVELOPMENTS AT THE FIFTY-THIRD SESSION OF THE TC

30. The TC, at its fifty-third session, noted the report on developments in the TWPs and BMT, as set out in document TC/53/11, paragraphs 5 to 24 (see document TC/53/31, paragraph 198).

31. The TC noted that the development of a joint document explaining the principal features of the systems of the OECD, UPOV and ISTA could only start after agreement by OECD and ISTA (see document TC/53/31, paragraph 199).

32. The TC noted that the development of a joint OECD/UPOV/ISTA document containing an inventory of molecular marker techniques used by crop could only start after agreement by OECD and ISTA (see document TC/53/31, paragraph 200).

33. The TC agreed that possible future collaboration between UPOV, OECD and ISTA might include the harmonization of terms and methodologies used for different crops and the possible development of standards, after agreement by those organizations (see document TC/53/31, paragraph 201).

34. The TC considered whether to explore circumstances in which the same techniques and information could be used by OECD, ISTA and UPOV, taking into account the different objectives of the organizations, and agreed that the organization by Naktuinbouw of a practical workshop in 2017, in Roelofarendsveen, Netherlands, from May 8 to 10, 2017, could explore such possibilities on the basis of real situations (see document TC/53/31, paragraph 202).

35. The practical workshop "DNA Techniques and Variety Identification" was held in Roelofarendsveen, Netherlands, from May 8 to 10, 2017. The agenda of the workshop is reproduced in Annex II to this document. A second practical workshop is planned to take place in September 2017.

36. The TC, at its fifty-third session, agreed that UPOV and OECD should consider making progress in the matters above if ISTA was unable to participate in the near future (see document TC/53/31, paragraph 203).

37. The TC noted the offer by the Netherlands to report on projects on the use of molecular techniques in DUS examination to the TWC (see document TC/53/31, paragraph 204).

38. The TC noted the offer by China to report its experience on the use of DNA databases of maize, rice and wheat when selecting similar varieties for the examination of distinctness to the TWC (see document TC/53/31, paragraph 205).

39. The TC noted that the TWC had agreed to invite presentations from members on the statistical aspects of using molecular markers in DUS examination, including the selection of similar varieties and organization of growing trials (see document TC/53/31, paragraph 206).

40. The TC noted the offer by France to make a presentation on current work with databases that included molecular information with computation of molecular distances using the GAIA software, to the TWC at its thirty-fifth session (see document TC/53/31, paragraph 207).

41. The TC noted that the TWC had agreed that software and databases as well as associated statistical methods were important elements of DUS examination and of increasing relevance to plant variety protection, and the Chairperson of the TWC should report on these particular elements of the work of the TWC to the TC (see document TC/53/31, paragraph 208).

42. The TC noted that a Joint OECD/UPOV/ISTA/AOSA Workshop on Biochemical and Molecular Methods had been held in Paris on June 8, 2016, and that the recommendations of the Joint OECD/UPOV/ISTA/AOSA Workshop as reproduced in document TC/53/11, paragraph 25, had been approved by the Annual Meeting of the OECD Seed Schemes, held in Paris on June 9 and 10, 2016 (see document TC/53/31, paragraph 209).

43. The TC noted that a question and answer concerning the information on the situation in UPOV with regard to the use of molecular techniques for a wider audience, including the public in general, had been adopted by the Council, at its fiftieth ordinary session (see document TC/53/31, paragraph 210).

44. The TC agreed to propose that the meetings of the BMT be held on an annual basis and that consideration be given to organizing the sessions of the TWC and BMT back-to-back in the same location to facilitate exchange of information (see document TC/53/31, paragraph 211).

45. The TWPs are invited to note:

(a) the report on developments in the TWPs and BMT, as set out in paragraphs 5 to 24 of this document;

(b) that a Joint OECD/UPOV/ISTA/AOSA Workshop on Biochemical and Molecular Methods was held in Paris on June 8, 2016, and that the recommendations of the Joint OECD/UPOV/ISTA/AOSA Workshop as reproduced in paragraph 25 of this document, were approved by the Annual Meeting of the OECD Seed Schemes, held in Paris on June 9 and 10, 2016;

(c) that a question and answer concerning the information on the situation in UPOV with regard to the use of molecular techniques for a wider audience, including the public in general, as set out in paragraph 29 of this document, was adopted by the Council, at its fiftieth ordinary session;

(d) that the TC, at its fifty-third session, agreed that possible future collaboration between UPOV, OECD and ISTA might include the harmonization of terms and methodologies used for different crops and the possible development of standards, after agreement by those organizations;

(e) that a first practical workshop "DNA Techniques and Variety Identification" was held in Roelofarendsveen, Netherlands, from May 8 to 10, 2017 and that a second practical workshop is planned for September 2017;

(f) that the TC agreed that UPOV and OECD should consider making progress in the matters above if ISTA is unable to participate in the near future; and

(g) that the TC agreed to propose that the meetings of the BMT be held on an annual basis and that consideration be given to organizing the sessions of the TWC and BMT back-to-back in the same location to facilitate exchange of information.

[Annexes follow]

ANNEX I

ROLE OF THE WORKING GROUP ON BIOCHEMICAL AND MOLECULAR TECHNIQUES, AND DNA-PROFILING IN PARTICULAR (BMT)

(as agreed by the Technical Committee at its thirty-eighth session, held in Geneva, from April 15 to 17, 2002 (see document TC/38/16, paragraph 204))

The BMT is a group open to DUS experts, biochemical and molecular specialists and plant breeders, whose role is to:

(i) Review general developments in biochemical and molecular techniques;

(ii) Maintain an awareness of relevant applications of biochemical and molecular techniques in plant breeding;

(iii) Consider the possible application of biochemical and molecular techniques in DUS testing and report its considerations to the TC;

(iv) If appropriate, establish guidelines for biochemical and molecular methodologies and their harmonization and, in particular, contribute to the preparation of document TGP/15, “New Types of Characteristics.” These guidelines to be developed in conjunction with the Technical Working Parties;

(v) Consider initiatives from TWPs, for the establishment of crop specific subgroups, taking into account available information and the need for biochemical and molecular methods;

(vi) Develop guidelines regarding the management and harmonization of databases of biochemical and molecular information, in conjunction with the TWC;

(vii) Receive reports from Crop Subgroups and the BMT Review Group;

(viii) Provide a forum for discussion on the use of biochemical and molecular techniques in the consideration of essential derivation and variety identification.

[Annex II follows]

ANNEX II

AGENDA OF PRACTICAL WORKSHOP "DNA TECHNIQUES AND VARIETY IDENTIFICATION"

8 - 10 May, 2017
Naktuinbouw, Roelofarendsveen, The Netherlands

AGENDA				***DNA techniques and variety identification***		***parallel Program***	
				Group 1		***Group 2***	
Monday, May 8, 2017				*Subject*	*By*	*Subject*	*By*
focus: introduction and DNA basics			*8:30*	*Transportation to Naktuinbouw*	*Bus*		
	9:00	-	*9:15*	*Registration*	*All*		
	9:15	-	*9:30*	*Introduction of participants*	*All*		
	9:30	-	*10:00*	*Lecture: Introduction to Naktuinbouw*	*Bert Scholte*		
	10:00	-	*10:20*	*Film about Naktuinbouw*	*Bert Scholte*		
Coffee	*10:20*	-	*10:50*	*coffee break*			
	10:50	-	*11:00*	*Agenda of the workshop*	*Bert Scholte*		
	11:00	-	*11:40*	*Lecture: DNA; the basics*	*Hedwich Teunissen*		
	11:40	-	*11:45*	*Video: sampling of potato*	*video*		
	11:45	-	*12:05*	*sample own potato*	*Menno Hoekstra / Alex Reid*	*make description of own potato and photographs of plants*	*Amanda van Dijk / Jan Kees Schipper*
	12:05	-	*12:25*	*make description of own potato and photographs of plants*	*Amanda van Dijk / Jan Kees Schipper*	*sample own potato and watch film of Variety reseach at Naktuinbouw*	*Menno Hoekstra / Alex Reid*
Lunch	*12:30*	-	*13:30*	*buffet*			
	13:30	-	*14:00*	*Lecture: Introduction to ISTA and developments on the use of DNA for variety identification within ISTA system*	*Chiara Delogu*	*Hands-on DNA extraction*	*Menno Hoekstra / Daniel Deinum / Alex Reid / Hedwich Teunissen*
	14:00	-	*14:30*	*Lecture: introduction to OECD and developments on the use of DNA for certification within OECD system*	*Gerry Hall*	*Hands-on DNA extraction*	*Menno Hoekstra / Daniel Deinum / Alex Reid / Hedwich Teunissen*
	14:30	-	*15:00*	*Lecture: introduction to UPOV and developments on the use of DNA for PVR within UPOV system*	*Leontino Traveira*	*Hands-on DNA extraction*	*Menno Hoekstra / Daniel Deinum / Alex Reid / Hedwich Teunissen*
Coffee	*15:00*	-	*15:30*	*coffee break*			
	15:30	-	*16:00*	*Hands-on DNA extraction*	*Menno Hoekstra / Daniel Deinum / Alex Reid / Hedwich Teunissen*	*Lecture: Introduction to ISTA and developments on the use of DNA for variety identification within ISTA system*	*Chiara Delogu*
	16:00	-	*16:30*	*Hands-on DNA extraction*	*Menno Hoekstra / Daniel Deinum / Alex Reid / Hedwich Teunissen*	*Lecture: introduction to OECD and developments on the use of DNA for certification within OECD system*	*Gerry Hall*
	16:30	-	*17:00*	*Hands-on DNA extraction*	*Menno Hoekstra / Daniel Deinum / Alex Reid / Hedwich Teunissen*	*Lecture: introduction to UPOV and developments on the use of DNA for PVR within UPOV system*	*Leontino Traveira*
	17:00	-	*21:00*	*Dinner in Kaag en Braassem*	*all*		
				Transportation to hotel	*Bus*		
Tuesday, May 9, 2017				***Group 1***		***Group 2***	
focus: genotyping technologies			*8:30*	*Transportation to Naktuinbouw*	*Bus*		
	9:00	-	*9:15*	*video on DNA quanitification and discusion on results DNA extraction previous day, compare different DNA extraction methods*	*video*		
	9:15	-	*10:00*	*Lecture: DNA amplification by PCR, real-time PCR and primer/probe design, optimization and validation*	*Alex Reid*		
Coffee	*10:00*	-	*10:30*	*coffee break*			
	10:30	-	*11:30*	*Lecture: overview PCR based genotyping technologies*	*Hedwich Teunissen / Alex Reid*	*Hands-on: performing SSR - PCR*	*Laboratory*
	11:30		*12:00*	*Lecture: The potato system*	*Alex Reid*	*Hands-on: performing SSR - PCR*	*Laboratory*
	12:00	-	*12:45*	*excursion: Naktuinbouw ISTA accreditated laboratory*	*Marco Hofman*	*excursion: Naktuinbouw CPVO accreditated Examination office- variety centre*	*Amanda van Dijk*
Lunch	*12:45*	-	*13:30*				
	13:30		*14:30*	*Hands-on: performing SSR - PCR*	*Laboratory*	*Lecture: overview PCR based genotyping technologies*	*Hedwich Teunissen / Alex Reid*
	14:30	-	*15:00*	*Hands-on: performing SSR - PCR*	*Laboratory*	*Lecture: The potato system*	*Alex Reid*
Coffee	*15:00*	-	*15:30*				
	15:30	-	*16:00*	*Lecture: KASP and conversion SSR markers to KASP markers*	*Joris Parmentier (LGC)*		
	16:00	-	*16:45*	*excursion: Naktuinbouw CPVO accreditated Examination office- variety centre*	*Amanda van Dijk*	*excursion: Naktuinbouw ISTA accreditated laboratory*	*Marco Hofman*
	16:45	-	*17.15*	*Lecture: DNA sequencing*	*Hedwich Teunissen*		
	17:15	-	*17:30*	*Video: Loading SSR reactions on LICOR gel and running*	*video/webcam*		
			17:30	*Transportation to hotel*	*Bus*		
Wednesday, May 10, 2017				***Group 1***		***Group 2***	
focus: data analysis and applications of genotyping			*8:30*	*Transportation to Naktuinbouw*	*Bus*		
	9:00	-	*9:30*	*Lecture: data analysis*	*Hedwich Teunissen*		
	9:30	-	*10:30*	*Demonstration: Bionumerics*	*iemand van Applied Maths, bijvoorbeeld Johan Goris of Bruno Pot, via live stream*		
Coffee	*10:30*	-	*11:00*	*Coffee break*			
	11:00	-	*12:00*	*Hands-on: exercise 1: translation of own potato fingerprint in similarity values with whole group and visualisation in dendrogram*	*Menno Hoekstra / Daniel Deinum*	*Hands-on: exercise 1: translation of own potato fingerprint in similarity values with whole group and visualisation in dendrogram*	*Menno Hoekstra / Daniel Deinum*
	12:00	-	*12:30*	*Discussion: results on potato analysis both groups*	*Hedwich Teunissen / Amanda van Dijk*		
Lunch	*12:30*	-	*13:30*	*buffet*			
	13:30	-	*14:15*	*Lecture: genotyping for QC by breeding industry*	*Mike Heimerikx (ENZA Zaden)*		
	14:15	-	*15:00*	*Lecture: management of reference collection: example French Bean*	*Amanda van Dijk*		
Coffee	*15:00*	-	*15:30*	*Coffee break*			
	15:30	-	*16:00*	*Lecture: Variety Tracer and Green Forensics*	*Hedwich Teunissen*		
	16:00	-	*16:45*	*Discussion: the future of genotyping for variety identification in certification, seeds testing and DUS testing*	*All*		
	16:45	-	*17:00*	*concluding remarks*	*Bert Scholte*		
				Transportation to Schiphol Airport/Trainstation	*Bus*		

[End of Annex II and of document]