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UNIÓN INTERNACIONAL PARA LA PROTECCIÓN DE LAS OBTENCIONES VEGETALES
Ginebra

COMITÉ TÉCNICO

Cuadragésima novena sesión
Ginebra, 18 a 20 de marzo de 2013

REVISIÓN DEL DOCUMENTO TGP/8: PARTE II: TÉCNICAS UTILIZADAS EN EL EXAMEN DHE, NUEVA SECCIÓN: EXAMEN DE CARACTERES MEDIANTE EL ANÁLISIS DE IMAGEN

Documento preparado por la Oficina de la Unión

1. El presente documento tiene por finalidad informar acerca de:

   a) los resultados del cuestionario sobre programas informáticos y equipos utilizados para el análisis de imagen;

   b) las ponencias sobre análisis de imagen presentadas ante el Grupo de Trabajo Técnico sobre Automatización y Programas Informáticos (TWC), en su trigésima reunión; y

   c) la elaboración del documento TGP/8: Parte II: Técnicas utilizadas en el examen DHE, nueva sección: Examen de caracteres mediante el análisis de imagen.

Antecedentes

2. En su cuadragésima octava sesión, celebrada en Ginebra del 26 al 28 de marzo de 2012, el Comité Técnico (TC) examinó la propuesta relativa a una nueva sección: "Examen de caracteres mediante el análisis de imagen", sobre la base del documento TC/48/19 Rev., "Revisión del documento TGP/8, Diseño de ensayos y técnicas utilizados en el examen de la distinción, la homogeneidad y la estabilidad", Anexo VII. El TC acordó que el Sr. Gerie van der Heijden (Países Bajos), el Presidente del Grupo de Trabajo Técnico sobre Automatización y Programas Informáticos (TWC) y la Oficina de la Unión elaboren un cuestionario sobre programas informáticos y equipos utilizados para el análisis de imagen, que se distribuirá entre los representantes de los miembros de la UPOV en el TC y el TWC. Los resultados del cuestionario se presentaron al TWC en su trigésima reunión, que se celebró en Chisinau, República de Moldova, del 26 al 29 de junio de 2012 (véase el párrafo 56 del documento TC/48/22 "Informe sobre las conclusiones").

Cuestionario de la UPOV sobre programas informáticos y equipos utilizados para el análisis de imagen

3. En su trigésima reunión, el TWC escuchó una ponencia a cargo de un experto de los Países Bajos, titulada "Cuestionario sobre programas informáticos y equipos utilizados para el análisis de imagen", que se reproduce en el documento TWC/30/39. El TWC convino en que la información procedente de Francia y de Finlandia debía incluirse en dicho documento (véase el párrafo 79 del documento TWC/30/41 "*Report*").

4. El Anexo I del presente documento (sólo en Inglés[*]) contiene el análisis del cuestionario de la UPOV sobre el análisis de imagen que figura en el documento TWC/30/39, así como la información proporcionada por Finlandia y Francia.

5. Se invita al TC a tomar nota de la información relativa a programas informáticos y equipos utilizados para el análisis de imagen que se incluye en el Anexo I del presente documento.

Programa informático AIM para el análisis de imagen

6. En su trigésima reunión, el TWC escuchó una ponencia sobre el programa informático AIM para la gestión del análisis de imagen, que fue presentada por un experto de Francia y se reproduce en el documento TWC/30/31 y en el Anexo II del presente documento (sólo en Inglés[*]). El TWC tomó nota de que el programa informático AIM estaba disponible en francés y de que su autor (el Grupo de Estudio y Control de Variedades y Semillas (GEVES)) podría proporcionarlo gratuitamente. El TWC señaló que, para lograr la difusión de este programa informático, resulta esencial traducirlo al inglés e impartir formación sobre su uso. También convino en que este programa informático puede incluirse en la lista de programas informáticos para intercambio. El TWC solicitó asistencia a la Oficina de la Unión para traducir el programa informático al inglés (véanse los párrafos 77 y 78 del documento TWC/30/41 "*Report*").

7. Se invita al TC a tomar nota de que la recomendación del TWC relativa a la inclusión del programa informático francés AIM en el documento UPOV/INF/16 "Programas informáticos para intercambio", y la petición a la Oficina de la Unión para traducir el programa informático AIM al inglés serán examinadas en el documento TC/49/12.

Documento TGP/8: Parte II: Técnicas utilizadas en el examen DHE, nueva sección: Examen de caracteres mediante el análisis de imagen

8. En su cuadragésima octava sesión, el TC examinó la propuesta relativa a una nueva sección 12, "Examen de caracteres mediante el análisis de imagen", del documento TGP/8. El TC acordó que se redacte nuevamente el texto de la subsección 12.1 "Introducción" de la nueva sección "Examen de caracteres mediante el análisis de imagen", para explicar que el análisis de imagen constituye un método alternativo, y no el método principal, de observación de un carácter. El TC convino en que el TWC elabore la subsección 12.3, "Orientaciones sobre el uso del análisis de imagen", y acordó que se prepare una nueva sección a partir de los debates sobre los documentos TWC/29/19 "*Image Analysis for DUS in the United Kingdom*" (Análisis de imagen para el DHE en el Reino Unido), TWC/29/21 "*The Use of Image Tool in Measurements of Grain Length of Rye (Secale Cereale L.)*" (Utilización de la herramienta de análisis de imagen en las mediciones de la longitud del grano del centeno (Secale cereale L.), TWC/29/27 "*Image Analysis in the Czech Republic*" (Análisis de imagen en la República Checa) y TWC/29/29 "*Image Analysis in the Netherlands*" (Análisis de imagen en los Países Bajos). Sus redactores serán expertos de los Países Bajos (primer redactor), la República Checa, Finlandia y el Reino Unido (véanse los párrafos 56 a 58 del documento TC/48/22 "Informe sobre las conclusiones").

9. En su trigésima reunión, el TWC acordó que un experto de los Países Bajos, en colaboración con un experto de la Unión Europea, elabore un borrador de la nueva sección "Examen de caracteres mediante el análisis de imagen" del documento TGP/8 "Diseño de ensayos y técnicas utilizados en el examen de la distinción, la homogeneidad y la estabilidad" para las reuniones de 2013 de los TWP (véase el párrafo 80 del documento TWC/30/41 "*Report*").

[*] En su reunión del 9 y 10 de enero de 2013, el TC-EDC convino en que no era adecuado traducir el texto para la cuadragésima novena sesión del TC.

10. Se invita al TC a tomar nota de los planes de elaborar una nueva sección, "Examen de caracteres mediante el análisis de imagen", que se incluirá en el documento TGP/8, Parte II: Técnicas utilizadas en el examen DHE, según lo expuesto en los párrafos 8 y 9 del presente documento.

[Siguen los Anexos]

TC/49/33

ANEXO I

(SÓLO EN INGLÉS)

ANALYSIS OF UPOV QUESTIONNAIRE ON IMAGE ANALYSIS

Prepared by Gerie van der Heijden (Netherlands)

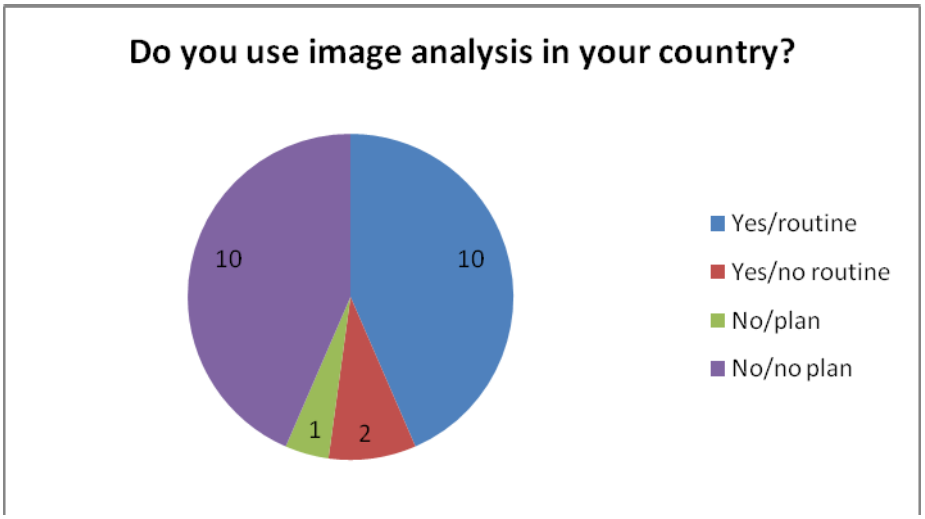
INTRODUCTION

1. A questionnaire on image analysis (see Appendix I to this Annex, which was an Annex to E-12/106) was sent to the UPOV members in April 2012. The aim of the questionnaire was to gain insight in the frequency and way of use of image analysis in the different member states.

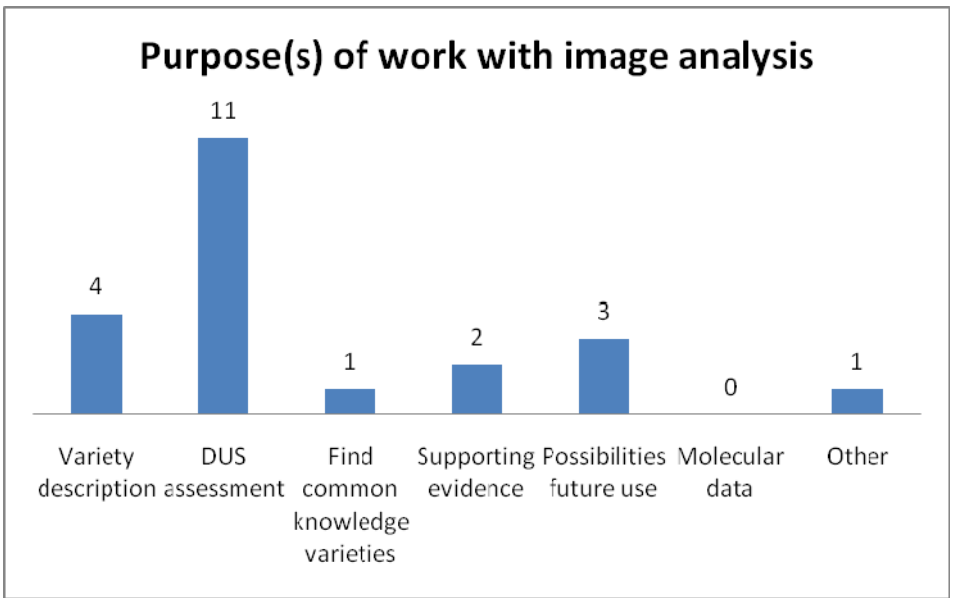
2. The questionnaire was returned by 21 UPOV members. The United Kingdom returned two questionnaires, one from England (NIAB) and one from Scotland (SASA), so there were 22 questionnaires in total. For sake of simplicity, England and Scotland are here treated as two different respondents. Results are shown in Appendix II to this Annex.

USE AND PURPOSE OF IMAGE ANALYSIS

3. In total ten respondents stated that image analysis is being used on a routine basis in their work, where France also uses it non-routine. Italy only uses it for non-routine purposes at the moment. Ten respondents do not use image analysis and have no further plans to use it, one country (Republic of Moldova) has plans to use it (see Figure 1 and Appendix II to this Annex).



4. The main purpose of image analysis is for DUS assessment. It is only occasionally used for variety description, finding common knowledge varieties or supporting evidence (see Figure 2 and Appendix II).



CROPS AND CHARACTERISTICS

5. The crops for which image analysis is being used are (in alphabetic order):

1. Barley 2. Brassica crops 3. Brussels sprouts 4. Carrot 5. Field bean 6. Flax 7. Fodder radish 8. French bean 9. Impatiens 10. Maize 11. Oats 12. Oilseed rape 13. Onion 14. Ornamentals 15. Parsnip 16. Pea 17. Pelargonium	18. Rape 19. Red clover 20. Rice 21. Running beans 22. Rye 23. Seeds/grains various crops 24. Sugar Beet (cotyledon) 25. Watercress 26. Wheat 27. White mustards 28. Willow (leaves)

6. Image analysis is mainly being used to measure the size and shape of seeds, leaves and roots/bulbs. A few ornamental crops like Pelargonium and Impatiens are listed. Also for these crops, the characteristics are size and shape related. France is the only country that uses it for color. No characteristics were mentioned which measure texture or variegation patterns.

7. All respondents who use image analysis on a routine basis, use it as intermediate data for the DUS decision. France also uses it to store information for future use.

TECHNICAL ISSUES

8. Eight respondents use a camera, five respondents use a scanner (two respondents use both options). All use a regular PC or workstation.

9. Every UPOV member has its own software system. Most respondents use commercially available software or open source software which they have adopted themselves. Only Italy uses off-the-shelf software. In some cases the software can be made available to other UPOV members (under conditions). See Appendix II for details.

10. The size of the data is hardly limiting with current disks. The largest reported database is about 300 GB.

RECORDING CONDITIONS

11. All respondents use some form of calibration for determining the size of an object. In general the lighting conditions are also standardized and verified. Color calibration is not mentioned.

[Sigue el apéndice I]

UPOV QUESTIONNAIRE ON IMAGE ANALYSIS AS SENT TO UPOV MEMBERS

Please complete the following questions. You can attach a separate sheet(s) to provide a more complete answer if necessary (e.g. if you have different projects/purposes with image analysis).

Name of person answering the questionnaire: ……

Country:……

Organization……

Contact Information:
Address: ……
Tel:…… Fax:……
E-Mail: ……

I. GENERAL QUESTIONS

1. Use of image analysis in your country

□ Yes
- □ Routine-basis
- □ Non routine-basis

□ No
- □ Planning to use
- □ No plans to use

** If the answer to the above question is "Yes", please go to the following questions. Otherwise please just return this sheet to the designated persons shown at the bottom of the circular.*

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2. UPOV Technical Working Party(ies) and document references in which information has previously been provided:

□ BMT [document reference: e.g. BMT/XX/XX]
□ TWA [document reference:]
□ TWO [document reference:]
□ TWV [document reference:]
□ TWF [document reference:]
□ TWC [document reference:]
□ TC [document reference:]
□ CAJ [document reference:]

3. Purpose(s) of the work with image analysis:

- ☐ Variety description
- ☐ DUS assessment
- ☐ To find varieties of common knowledge to compare with candidate varieties in the DUS growing trials
- ☐ Supporting evidence in selected cases
- ☐ To evaluate possibilities of the method for future use
- ☐ Molecular data (e.g. banding patterns in electrophoresis gels)
- ☐ Other purpose, (please provide details):

4. Application of image analysis (species, characteristics, etc.)

5. Status of the image analysis data:

- ☐ Provided by breeder for information on voluntary basis
- ☐ Compulsory requirement for the breeder as part of the application
- ☐ As intermediate data to obtain information before the DUS decision
- ☐ To keep as retrievable information for use in other studies
- ☐ Other status, namely (please provide details):

6. Please provide a short indication of the costs and savings involved in applying image analysis.

7. Please provide other remarks, if any.

II. TECHNICAL QUESTIONS

**** In the case of another person(s) (e.g. IT technicians) answering the following questions, please specify below the person's name, organization/title, telephone, fax number and e-mail address in order for us to contact them when necessary:***

……

1. Hardware used (make, model, type, etc.) by steps:

□ To obtain images: .....

□ To keep and process data: .....

□ To show images on screen or paper: .....

2. Software used (make, title, version, etc.) by steps:

□ To obtain images:

□ To keep and process data:

□ To show images on screen or paper

3. Is the hardware/software commercially available?

(To obtain images)
□ Yes, from ……..……
□ Partially, we added own routines/macros
□ No, specifically developed
□

(To keep and process data)
□ Yes, from ……..……
□ Partially, we added own routines/macros
□ No, specifically developed

(To show images on screen and paper)
□ Yes, from ……..……
□ Partially, we added own routines/macros
□ No, specifically developed

4. With regard to the software specifically developed for you, is it also available to other UPOV members?

☐ Yes
☐ No
☐ Under certain conditions (please specify the condition below)

5. Please summarize the recording conditions (standardization of light, sampling density, camera type, calibration procedure, etc.)

6. Approximate volume of data kept (either Megabytes, or number of varieties, number of features, number of images, etc.)

7. Other remarks (if any):

NB: If you use image analysis for other work than variety testing (seed testing, checks for purity in maintenance, etc.) and you are willing to give information, please do so.

Please return the completed questionnaire no later than May 11, 2012 by e-mail to:

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[Sigue el apéndice II]

Results of UPOV questionnaire on Image Analysis

	1.Use of image analysis				2. UPOV Document	3. Purpose		
Member state	**Yes routine**	**Yes no routine**	**No/ plan**	**No/ No plan**		**Variety description**	**DUS assessment**	**Other**
Czech Republic*	1				TWC/29/27		1	
Denmark*	1						1	
Georgia				1				
Germany*	1				TWO/29/17		1	Common knowledge varieties
Finland	1				TWC/29/21		1	
France	1	1			TWC/30/31		1	Future use and VCU
Ireland				1				
Israel				1				
Italy*		1				1	1	
Japan				1				
Latvia				1				
Republic of Moldova			1					
Netherlands*	1				TWC/29/29	1	1	Supporting evidence
Paraguay				1				
Poland*	1						1	
Russia				1				
South Africa				1				
Spain*	1					1	1	
Sweden*				1				
United Kingdom (NIAB)*	1				TWC/29/19	1	1	Supporting evidence
United Kingdom (SASA)*	1				TWA 33/10, TWC 22/7, TWC 26/21 REV, TWC 29/19 (Image-in), TWC 19/6 (Visor)		1	
United States of America				1				

*) Respondents in grey area have provided more information. See following pages.

Czech Republic

Application:

- Pea: leaves, stipules, standards, sepales
- Oilseed rape: petals, cotyledons

Technical

1. Hardware camera	1. Hardware processing	1. Hardware display
Sceye 3rd generation, proprietary light system	common PC	common PC

2. Software recording	2. Software processing	2. Software display/print	3. Commercially available	4. Available to other members
Sceye	Matlab computational system, core + Image analysis toolbox (http://www.mathworks.com/)	outputs of Matlab are saved as common image files, no special software is required	Capture: http://www.sceye.eu/en/products/product-history. Process: partially, added own	No

5. Recording conditions	6. Volume of data	7. Other remarks
Image obtained in dark chamber, resolution 300 pt, calibration using coin.	Per year: Pea 5 GB, Oilseed rape 20 GB.	Image analysis in the Czech Republic is still under development, primary goal: resting suitable characteristics for pea and oilseed rape

Denmark

Application:

- Rape seed: Cotyledon, Petals and Siliqua
- Barley: Ear length, Ear length of awns
- Wheat. Ear length

Cost/saving:
Total cost for hard and software of applying image analysis are approximately 20.000 euros. Cost savings are mainly obtained in the image analysis of Rape seed characteristics of the siliqua. An advantage using image analysis is that it is possible to retrieve the image of the actual recorded data.

Technical:

1. Hardware camera	**1. Hardware processing**	**1. Hardware display**
PC and flatbed scanner (plustec A3)	PC	PC

2. Software recording	**2. Software processing**	**2. Software display/print**	**3. Commercially available**	**4. Available to other members**
Videometer image analysis progra	Videometer image analysis progra	Microsoft picture viewer	No, specifically developed	Possible to buy if you contact: http://videometer.com/ with a reference to The Danish AgriFish Agency, Department of Variety Testing

5. Recording conditions	**6. Volume of data**	**7. Other remarks**
The material samples (cotyledon and petals) shall be fixed on paper with adhesive plastic foil. The paper has preprinted barcode, plot number etc.. The paper with the fixed the material are put in the flatbed scanner. Before image analysis of each characteristic can begin the software should calibrated using a calibration sheet from the developer	Approximately 14 Gb per year	

Germany

Applications:

- Pea, pelargonium, impatiens, willow (leaves)
- Rape, mustard, fodder radish (leaves, flowers)
- Red clover (Cotyledon leaves, first leaves)

Costs/savings:
Depending on crop and object savings are higher than costs.

Other remark:
There is a need for a programmer with special knowledge how (at least part-time). It is possible to scan images at first and to make measurements later when there is more time therefore.

Technical:

1. Hardware camera	1. Hardware processing	1. Hardware display
flatbed scanner, digital camera	HP workstation xw4400	19" monitor

2. Software recording	2. Software processing	2. Software display/print	3. Commercially available	4. Available to other members
standard software (scanner, digital camera)	SCIL-Image with self-programmed routines	JAVA program to retrieve images from database	Recording: Yes, from HP and Canon. Process: no. Display: partially	No

5. Recording conditions	6. Volume of data	7. Other remarks
Scanner: scan calibration circle (Ø12cm) to get the resolution we don't use the color information digital camera: flash (ring flash) and background light	2011: 80 GB image data (14.300 files)	

Finland

Application

- Rye: grain length

Cost/savings:
After arranging the seeds for the picture and taking of photographs, the analysis takes only a portion of time compared to manual measurements. Accurate costs and savings of IA has not been done, but roughly 10-20% of time is needed by using IA in these measurements.

1. Hardware camera	1. Hardware processing	1. Hardware display
Canon EOS 500D	PC	Dell screen

2. Software recording	2. Software processing	2. Software display/print	3. Commercially available	4. Available to other members
	¨ UTHSCSA ImageTool for Windows Version 3.0	Windows picture manager	Capture: in camera shops, Process: downloadable from http://compdent.uthscsa.edu/dig/itdesc.html, Display: Windows Office 2012	

5. Recording conditions	6. Volume of data	7. Other remarks
Calibration: Seeds are kept close to each others in the picture to avoid distortion by the objective. The ruler is used for calibration of the scale in the picture before taking the analysis picture. Scale of 1 cm is included in each varietys pictures for calibration in the IT program	130 MB/each DUS year	

France

Application
Crops:

- Carrot, Rape,
- Ornamentals,
- Seed/Grains various crops,
- Wheat,
- Barley,
- Maize,
- Oat,
- Pea.

Characters:
Width, Length, Area, perimeter, Curve length, Curve Width, Color, Mean distance, fineness of foliage, attack disease on leaves, how plant cover the ground, …

1. Hardware camera	**1. Hardware processing**	**1. Hardware display**
different cameras (Nikon, Canon, Sony, HP, Olympus) and scanners (Epson, HP)	HP workstation	HP workstation

2. Software recording	**2. Software processing**	**2. Software display/print**	**3. Commercially available**	**4. Available to other members**
standard software (scanner, digital camera)	Aim Software (Own development) + ImageJ (with own macros, plugins)	Aim software	Yes, from GEVES	Yes

5. Recording conditions	**6. Volume of data**	**7. Other remarks**

Italy

Application

- Rice: grain size

Costs/savings:
Cost of system (software+scanner) € 8000.

Technical:

1. Hardware camera	1. Hardware processing	1. Hardware display
Scanner Epson Perfection V7000	PC	Normal monitor

2. Software recording	2. Software processing	2. Software display/print	3. Commercially available	4. Available to other members
Winseedle 2010a	Winseedle 2010a	Winseedle 2010a	Yes, Regent instruments	Commercially available

5. Recording conditions	6. Volume of data	7. Other remarks
Winseedle comes with an optical scanner and a special lighting system that minimizes shadows		

The Netherlands

Applications:

- Flax : length, width of seed; Under contruction: length, width and ratio length/width of boll
- Sugar beet: length, width, area cotyledons:
- French beans and Running beans: length (excluding beak), width, total length and degree of curvature of pod; length of beak
- Pea: length, width, degree of curvature of pod
- Carrot: length, max. width, ratio length/width, width of crown, form factor, mean width, ratio width/length of root; Under construction: root shape

Technical

1. Hardware camera	**1. Hardware processing**	**1. Hardware display**
D90 + AF-S Nikkor 18-105mm/3.5-4.5	HP Compaq	HP Compaq

2. Software recording	**2. Software processing**	**2. Software display/print**	**3. Commercially available**	**4. Available to other members**
NKremote 1.2 software for Windows	ImageJ with custom made plugin.Windows Excel, Genstat for statistical analysis	Microsoft Office Picture Manager	Camera hardware/software commercially available; Processing: ImageJ specifically developed. Windows Office and Genstat commercially available (own routines added)	To be discussed

5. Recording conditions	**6. Volume of data**	**7. Other remarks**
Calibration with use of calibration disc. Standardization of light – variable per crop, determination of the exposure of the photographed objects (shutter time, diaphragm and the quantity of light) is based on the histogram which is available via the software (NKremote) for the camera. Specific requirements per crop such a orientation of the objects, e.g. carrot all carrots need to be oriented horizontal.		

Poland

Applications:

- Our application is measuring 8 characteristics of oilseed rape and white mustard using scanned bitmap pictures. Results are written to database

Technical:

1. Hardware camera	1. Hardware processing	1. Hardware display
HP Scanjet 4850		

2. Software recording	2. Software processing	2. Software display/print	3. Commercially available	4. Available to other members
HP Software	Skaner-Sten	Skaner-Sten	Process and display: specifically developed	No

5. Recording conditions	6. Volume of data	7. Other remarks
Calibration: we have to scan the model of colour and size and test it using “Skaner” application.	about 1000 images per year, (6GB per year)	

Spain

Applications:

- Characteristics of grain (length and width) in rice, chickpea, etc

Technical:

1. Hardware camera	1. Hardware processing	1. Hardware display
COLOR VIDEO CAMERA; MODEL: JVC TK-C1481B	COMPUTER: DELL DIMENSION DIM5000, INTEL PENTIUM4 3GHZ, 256 MB RAM	LCD MONITOR; DELL E1705C

2. Software recording	2. Software processing	2. Software display/print	3. Commercially available	4. Available to other members
MIP 4 ADVANCED 5.01.02	MIP 4 ADVANCED 5.01.02	MICROSOFT EXCEL 2007	Yes, from Digital Image Systems (DIS)	No

5. Recording conditions	6. Volume of data	7. Other remarks
LIGHT= 2 36W SAMPLING DENSITY: 12 – 50 grains for variety CAMERA TYPE: color video camera CALIBRATION PROCEDURE: We use a ruler as reference and we follow the calibration instructions of the program.	approx 50 KB per variety	

Sweden

Remark:
We are using a seed scanner for analysis of "other species" in cereals. This machine uses image analysis (a camera connected to a computer with programs for the different cereal species) for distinguishing between the seed in the sample and other seeds. In a sample it sorts out around 10% of the seeds, both of other seeds and seeds that are somehow considered not OK, so instead of manually going through 1000 gr the analyst can go through around 100 gr. This saves a lot of time. The scanner can be loaded with up to 30 samples and works even during nights.

United Kingdom (NIAB)

Applications:

- Oilseed.rape: cotyledon measurements;
- Oilseed.rape: siliqua measurements;
- Oilseed.rape: flower measurements;
- Field.Bean: leaf measurements;
- Field.Bean: siliqua measurements;

Technical:

1. Hardware camera	**1. Hardware processing**	**1. Hardware display**
Digital SLR (Olympus E-1 camera), Kaiser R2-CP Image Capture Set	Optiplex 788, quadcore with 64 Bit operating system	Dual PC monitors

2. Software recording	**2. Software processing**	**2. Software display/print**	**3. Commercially availble**	**4. Available to other members**
Bespoke program Analysis application written in C++ and Olympus Studio Controller	Bespoke program Analysis application written in C++ and Olympus Studio Controller	Bespoke program Analysis application written in C++ and Olympus Studio Controller	No	No

5. Recording conditions	**6. Volume of data**
The Digital System is based on a digital camera using 2 11w lights @ 6000k which equate to natural light. The camera is suspended above a level surface. A reference object is incorporated into every picture. The IA program links with the Olympus studio Controller. The controller has special routines to handle camera aperture white noise etc. The linkage program has been specifically adapted by a consultant to allow menu driven options for each crop and to allow the entry of plot numbers. Once the controller has taken a picture the file is downloaded and re-opened by the IA program running in the background. The IA program will automatically analyze the picture and store the results in a data file. This allows the user to move any touching or irregular objects, thus equating to a live system. However the Controller can be used in isolation, storing the images to be batch processed at a later time. Once all plots have been photographed and analyzed via the batch process, thumbnail images can be examined and any outliers can be removed.	300 GB

United Kingdom (SASA)

Applications:

- Pea: Stipule. measurement, Petiole. measurement, Pod measurement, Peduncle measurement; Leaflet measurement, Seed shape measurement;
- Parsnip: Root measurement;
- Brassica crops: Cotyledon measurement;
- Brussels Sprout: Sprout measurement;
- Watercress: Foliage measurement;

Costs/savings:
Automated image measurements perform at least as well as manual measurements. Overall costs between manual (more recording) and imaged (more collection) measurements are about the same – but IA enables measured characters to be recorded which could not be done manually (e.g. leaflet area). Image library becomes available 1) For reference; 2) For data checking 3) for subsequently developed characters

Other remark:
We have downloaded a copy of the freely available Image-J software and have used it to investigate the possibility of assessing seed shape in large seeded crops but as yet we have not used this method in relation to variety testing.

Technical:

1. Hardware camera	**1. Hardware processing**	**1. Hardware display**
Canon EOS 450 DSLR (lab) Nikon D700 DSLR (studio)	SASA network	SASA network PCs (Dell) and printers (various

2. Software recording	**2. Software processing**	**2. Software display/print**	**3. Commercially available**	**4. Available to other members**
Canon	Imag-in' Automatic Measurement Program (Biomathematics and Statistics Scotland) and 'Portfolio' v8.5 image database (Extensis).	Portfolio	camera and display yes, processing software no	No

5. Recording conditions	**6. Volume of data**
The Digital System is based on a digital camera using 2 11w lights @ 6000k which equate to natural light. The camera is suspended above a level surface. A reference object is incorporated into every picture. The IA program links with the Olympus studio Controller. The controller has special routines to handle camera aperture white noise etc. The linkage program has been specifically adapted by a consultant to allow menu driven options for each crop and to allow the entry of plot numbers. Once the controller has taken a picture the file is downloaded and re-opened by the IA program running in the background. The IA program will automatically analyze the picture and store the results in a data file. This allows the user to move any touching or irregular objects, thus equating to a live system. However the Controller can be used in isolation, storing the images to be batch processed at a later time. Once all plots have been photographed and analyzed via the batch process, thumbnail images can be examined and any outliers can be removed.	300 GB

[Sigue el Anexo II]

ANEXO II

(SÓLO EN INGLÉS)

AIM: MANAGEMENT OF IMAGE ANALYSIS – EXPERIENCE FROM FRANCE

Groupe d'Étude et de contrôle des Variétés Et des Semences

AIM

Management of Image Analysis

Experience from France

June 26 to June 29, 2012 (*Chisinau, Republic of Moldova*)

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PROGRAM OF THE TALK

- GENERAL ARCHITECTURE OF AIM APPLICATION
- Major reasons which have justified the implementation of Image analysis solution like Aim
- MAIN FUNCTIONALITIES PROVIDED BY AIM APPLICATION
- DATA MODEL OF AIM

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BEFORE TO START ….

This presentation is not a training course on how to use ImageJ or on particular method of image analysis but rather on a tool that we've developed using to manage different projects :

- dealing with image analysis
- With on the one hand **ImageJ**
- and on the other hand a **Database**.

This tool named AIM (A = Analysis , IM = IMage) pilot the backoffice to declare, display, store, launch, retreive, ….

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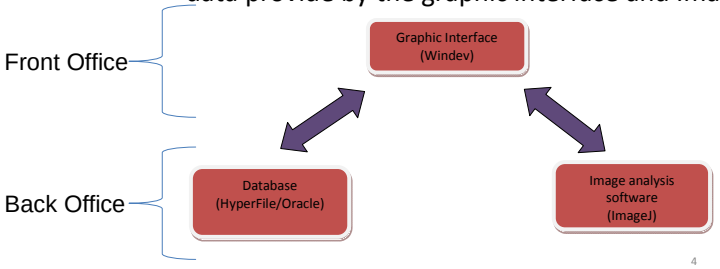
GENERAL ARCHITECTURE

The Aim application is based on the following architecture

A front office → Graphic Interface written with the development tool Windev to manage studies (Declare, Retreive, Export, Calculate, Levels of agregation, …)

A back office → Image analysis software with the freeware ImageJ to define processing applied on images

Database software with Hyperfile or Oracle to store data provide by the graphic interface and Image analysis



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Main reasons

The main purpose of Aim is to centralized and shared image analysis at GEVES

Through this main goal :

- Centralized processing
- Ease processing
- Share our knowledge and experiences
- Standardize the results and controls
- Use benefits offer by database (Integrity, Access rights, Backup, Query, Link with other information system, ….)

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MAIN FUNCTIONALITIES

Through differents examples we are going to show the use of AIM application :

- 1er – How to define and store macros Image-J
- 2nd – How to declare the framework of studies
- 3ème – How to launch processing on images
- 4ème – How to integrate measurement calculate by processing on images into database
- 5ème – How to define and calculate new variables dynamically
- 6ème – How to group/aggregate results (to the variety, to the replicate,…)

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Main functionalities
Example 1 : Assess how plant cover the ground

Context = The user has a list of images of several varieties and he wants to assess how each of these varieties cover the ground.

- Define a macro to separate the plant covering from the uncovered ground and measuring the ratio.
- Declare the framework of the study.
- Load images and launch analysis on each image.
- Open and store the file result.

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Main functionalities
Example 3 : Assess attack disease on leaves

Context = The user has several varieties and he wants to assess the attack of disease on leaf in controlled environnment. He scans one image per variety and on each image he's got several leaves.

- Define a macro to calculate the ratio between the area cover by disease and the area of leaf
- Define the framework of the study.
- Load images, select macros ImageJ and launch processing.
- Open the file result and integrate its content into database.
- Transform area from pixels to square millimeters

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Main functionalities
Example 3 : Assessement of fineness of foliage

Context = The user has several varieties of carrot and he wants to assess the fineness of foliage. He scans one image per variety and on each image he's got several leaves

- Define a macro to calculate the ratio between area of leaves and perimeter of leaves.
- Define precisely the framework of the study.
- Load images, select macros ImageJ and launch processing.
- Open the file result and integrate its content into database.
- Define several grouping to get results for :
  - Each Replicate
  - Each Variety
  - ……

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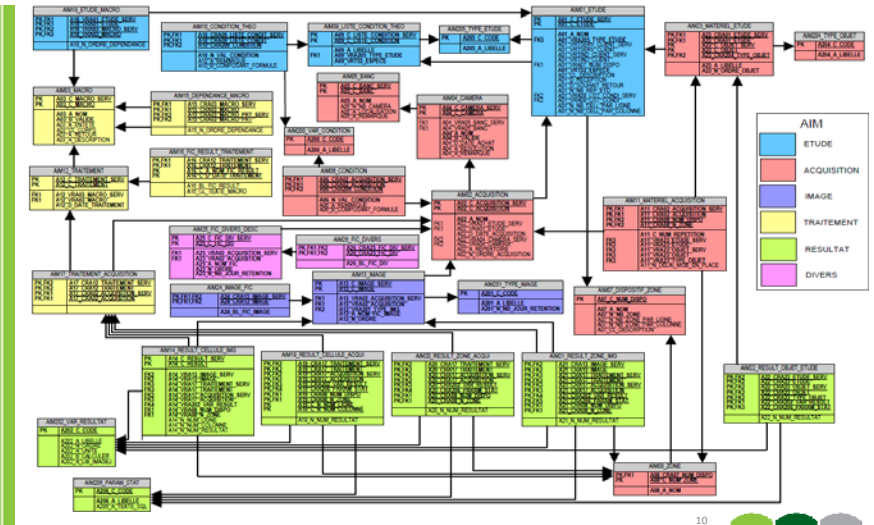
DATA MODEL OF AIM APPLICATION



[Fin del anexo II y del documento]